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UNIVERSITY OF ALBERTA

Forestry Economic Rents in Alberta
- Efficient and Equitable Treatment.

by

© MARK PETER ANIELSKI

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF SCIENCE

IN

FOREST ECONOMICS

DEPARTMENT OF RURAL ECONOMY

EDMONTON, ALBERTA

FALL 1991

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ISBN 0-315-70167-6

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ABSTRACT

This is a study of forest economic rents in Alberta and on the general issue of resource pricing or valuation, topics which remain as important policy issues for provincial governments in Canada today. Few studies exist on the subject of forest rents in Canada. The determination of resource economic rents and their collection through tax mechanisms is particularly important for resource-based economies, such as Alberta. A discussion and analysis of resource rents generated from forest industry activity in Alberta is particularly timely in light of the current unprecedented development of the industry and unprecedented allocation of timber resources.

This study provides a detail assessment of forest resource economic rents and their collection by government based on a thorough discussion of the resource rent theory literature

Several major issues were examined. The first was an examination of the forest economic rents generated by the Alberta primary forest industry from 1979 to 1990. Two methods were used in estimating the forest economic rents: a) a residual valuation approach where rent is computed as the difference between observed forest product prices less the sum of variable production costs and the opportunity cost of capital, inclusive of an allowance for returns to capital investment, profit and risk, and; b) a value added approach using Statistics Canada derived value added data for the Alberta forest industry manufacturing activity less labour costs and an estimated opportunity cost of capital (the cost estimates as used in the residual valuation approach). Rent figures are determined according to forest product or forest industry categories. There is no *a priori* information that suggests one method of rent estimation is superior to the other; in fact, we would expect the results to be fairly similar because they share common price and cost data components.

The empirical analysis reveals that between $53.9 million (value added method) and $69.3 million (residual valuation method) (in constant 1986 dollars) in forest rents were generated per annum from 1979 to 1990, on average. The vast majority of forest rents were generated by the pulp and paper industry while the lumber industry, while accounting for an average 62 per

cent of total annual timber harvest, generated considerably less rent (even negative rents, in the case of the residual valuation results).

The second issue examined was the success of the Alberta government in collecting forest economic rents during the study period 1979 to 1990. An analysis of taxation and thus rent collection of the Alberta forest industry by both provincial, federal and municipal governments reveals that an estimated 70 percent (residual valuation) and 90 percent (value added) of available rents (per annum) generated by primary forest products manufacturing activity were collected through stumpage fees, corporate income taxes, lumber export taxes, other forestry charges, and municipal property taxes. The study found that the Alberta government collected between 42 percent (residual valuation) and 54 percent (value added) of total available rents (per annum) through stumpage fees, corporate income taxes, and other forestry charges. If we consider stumpage pricing and other fees as the primary means for rent collection, the Alberta government collected between 29 percent (residual valuation) and 38 percent (value added) of rents through these indirect taxes. What is of particular interest, is the share of rents collected through corporate income taxes, many of which accrue to the federal government.

The success or failure of governments in collecting rents cannot be criticized from an economic theory perspective alone but must be considered in the context of resource management and fiscal policy objectives of the government. It can be said that the provincial government could have ensured greater economic rent collection control through more stringent and equitable stumpage pricing. This however, would have been at the expense of fewer rents accruing to both federal and municipal governments. However, that the current forest rent collection regime, based as it is on corporate tax capture, has inherent distortionary tendencies (according to economic theory) and has been relatively insensitive to the fluctuations in forest product markets.

The study shows that the Alberta government has adopted largely a system of *ex post* forest rent collection policies using a combination of administered stumpage pricing (including other minor forestry charges) and corporate income taxes. Alberta has adopted a fairly simple administrative stumpage pricing system in which prices are administratively set by the government or , in the case of Forest Management Agreements, negotiated into the actual contract agreement. The system of stumpage pricing has not changed substantially since 1975.

Finally, the study suggests that there are rent collection and timber pricing policies available that could be adopted which would be more sensitive to the dynamics of forest product markets and which would ensure rent collection by the Alberta government is maximized. While the most appropriate means of forest rent collection should be through a single stumpage pricing structure, the current tenure and tax systems lend themselves more to the adoption of two-tier rent collection system. The first tier would use stumpage pricing as the primary means of rent collection, using an appraisal or capital asset pricing approach (similar to the residual valuation method used in this study). The second tier would use the current corporate income tax structure to collect any residual rents that remain. Such a tax scheme has desirable qualities including, being neutral to the production decisions of firms (since a resource rent tax would be levied after costs of production are incurred), it would be sensitive to the unique operating conditions of individual forest product industries, it would encourage firms to invest in reforestation and other forest management activities (since such expenditures would be deductible as costs in the rent imputation). Furthermore, timber pricing under such a rent collection scenario would help to encourage the efficient and equitable use of a public timber resource and could provide the government with important information on how to maximize returns on investments in the allocation of forest resources.

ACKNOWLEDGEMENTS

I thank all the members of my committee including, Dr. Mike Percy, Dr. Luis Constantino, Dr. Roger Smith and Dr. Bill White, for making the defense an enjoyable event, especially Mike's invitation of the Friends of the North "reporter" to slow my heart rate. I thank you for your contribution to the thesis, for the good academic debate which ensued, and, most importantly, for your friendship.

I want to give special thanks to Dr. Mike Percy, for his relentless coaxing and positive reinforcement which helped me conquer this most momentous task. My life is richer because of our friendship and I am grateful for the wisdom and insights you have shared with me.

To the staff, colleagues and friends of the department of Rural Economy I give my thanks. Especially to Dr. Bill Phillips, my mentor and source of optimism for so many years. Thank you to Barb in the library, to Peter Boxall, for helping me keep my sanity through macroeconomics, and to Kelly Knox, for his friendship and many dinners at Pasta Presto in HUB mall.

Thank you to all those at Resource Information Services Inc., in Bedford, Mass., for the data that was so vital to the empirical work. To Gary Howe, Alberta Bureau of Statistics, for his assistance in accessing Statistics Canada data.

I want to also thank the Alberta government, Department of Forestry, Lands and Wildlife for supporting my education leave and employing me. Special thanks go to Per Anderson, my director, for his support and encouragement, and to Mr. Fred McDougall, former deputy minister, for his encouragement and support. And finally, to all those other friends and staff of Corporate Services and Strategic Planning and the rest of the ninth floor gang for their patience.

To my sister Karen for her patience, love, encouragement, and compassion as I journeyed through a long and laborious ordeal towards becoming a "master." To my parents, Oma and Opa, and my sister Andrea, for their eternal love and forgiveness for the time I did not spend with them. Also, to my parents, for instilling in me a sense of joy for life, a truly great adventure. To my many dear friends including, Esmeralda, Doug, Dan (Gwak), Brian, Bettiann, Martin and Mary Ellen, Bernice, and Chris, for their love and friendship.

Perhaps most importantly, I thank God for loving me and carrying me through both the oasis and desert of my graduate student existence. The thesis represented a journey, both pleasant and painful, and through it my faith has grown and my understanding of God's love, which is eternal. Through prayer I have I come to realize many things, that life should be full of celebration, joy, sharing, compassion and love.

For anyone I have forgotten, I thank you for your love, now and eternally.

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CHAPTER I

INTRODUCTION

A. Introduction

Resource economic rents, particularly forestry economic rent,and their generation and collection, via tax instruments, is one of the most important policy issues of resource abundant countries, such as Canada. Economic development in Canada, especially Alberta, has been characterized as export led, based upon the exploitation of natural resources. In the Canadian context, jurisdiction over natural resource pricing and regulation is a provincial responsibility. The provincial government, in this respect, has the dual role of both owner/proprietor and as agent/steward of natural resources. The role of provincial governments includes, ensuring that maximum benefits (both market and non-market) are realized from public resource use, in part, by ensuring that economic rents, that are generated as a result of resource utilization, are maximized.

Maximizing economic benefits or rents from natural resource use and government collection of these rents must consider the efficiency of allocation and distributional effects of such actions. The pricing of natural resources is the mechanism adopted by provincial governments to ensure that resource values are both realized and maximized. Accurate resource pricing plays an important role in the allocative efficiency of resource use by providing the correct utilization and market entry signals to industry. Pricing ensures that natural resources are allocated to their highest value use and ensures that proprietary rights of the collector/owner of the resource base are realized and equitably distributed.

Economic rent has been defined by Boulding (1948) as "any payment to a unit of a factor of production, in an industry in equilibrium, which is in excess of the minimum amount necessary to keep the factor in its present occupation." An understanding of resource economic rents, and to that extent resource values, is becoming a critical issue to how the concept of sustainable development will be implemented. Sustaining the quality and quantity of natural resource assets and ensuring their continued services today and for future generations requires not only ensuring that the biophysical aspects or qualities of the resource are maintained but also that the value or rents of those resources are maximized to ensure societal welfare is maintained. Recent efforts by both developing and developed countries into natural resources and environmental accounting underscores the importance of both understanding, measuring, and realizing economic rents and values that arise from natural resources, particularly forest resources.[1] When referring to natural resource use and value derived from their use, it should be recognized that rent or value can be derived anywhere along the use continuum, from preservation to full exploitation

This study examines the issue of forestry economic rents arising from forestry production in Alberta and their efficient and equitable treatment and collection by government(s) through various tax regimes. It addresses several issues with respect to economic rent collection by the Alberta government. It will first consider the extent of forest rent generation from 1979 to 1990 generated by forest industry activity. Secondly, the study examines the historical success rent collection by all levels of government and tax systems. The primary focus is on the Alberta government's role and success in the collection of forest economic rents from the forest industry using numerous taxation instruments (including stumpage fees) , thereby enforcing property rights,as owner and steward of the forest resource. The performance of the entire tax system in collecting economic rents will be assessed on efficiency and equity terms. This performance must be considered in relation to explicit and implicit government policy objectives , including objectives such as economic development and diversification, employment generation, integrated resource management (including managing for non-timber resources and values), and specific forest management objectives.

The study will consider, in light of historical evidence, what forest economic rent collection systems are available to the Alberta government (as well as other provincial governments) in the future; a future where the forest industry is likely to face increasingly reliance on second growth timber and more stringent operating conditions, including increasing forest management and stand tending obligations, increasing non-timber resource management obligations (such a wildlife and aesthetic forest management), and increasing environmental regulation. It is important that, in the transition from an old-growth forest to the a new, more intensively managed forest, that rent collection mechanisms be sensitive to meeting sustainable resource management objectives and provide a suitable investment climate for firms willing to invest in future forest capital. The development of forest tenure regulations and tax systems in achieving sustainable resource objectives are both inextricably linked and may well require new and innovative policy solutions. Several taxation systems are examined as to their potential impact on economic rents and their effects on forest industry investment and forest management, in general.

---

[1] Recent attendance at an international conference on Natural Resource Accounting sponsored by the World Resources Institute, Washington, D.C. (Vancouver, B.C., March 5-6,1991) showed that many nations are taking increasing interest in determining resource rents, especially forest rents. This is part of a larger initiative of accounting for the depreciation or appreciation of the value of natural resources and building these changes into the System of National Accounts and Gross Domestic Product.

B. General Problem and Previous Research

The existence of economic rents and the taxation of these rents is one of the most fundamental issues addressed in both forest economics and resource economics literature, yet, very little hard empirical analysis exists for Canada or Alberta as to whether or not forest economic rent collection has been efficient and equitable with respect to the forestry sector. Studies by Percy (1986), Haley (1980), Heaps (1985), Schwindt (1987), and Nautiyal (1980) have examined stumpage collection and taxation in the Canadian forestry sector, with the prime focus on British Columbia. However, most of these studies have concentrated primarily on the use of stumpage pricing policies as a sole means of economic rent collection from the forestry sector, and have not considered the broader spectrum of all taxation mechanisms and their impact on the sector. Studies of resource pricing and rent collection in other resource sectors such as the oil and gas, and mining sector are more abundant (Helliwell ,1982; Helliwell and Heaps ,1983; Kemp, 1987). Typically, economic rents have been more substantial in these sectors compared to the forestry sector.

Copithorne's (1979) study for the Economic Council of Canada provided new insights and empirical evidence as to the importance of economic rents to the British Columbia and other Canadian provincial forestry sectors. Copithorne concluded that, identifying, measuring, and efficiently collecting economic rent from the forestry activity in British Columbia was vital to the proper functioning of the economic system, without distortions. He noted that existing policies,in British Columbia, apparently failed to recognize the importance of resource rent collection and how failure to collect these rents, combined with an already imperfect timber market structure, can lead to distortions in wages and forest product prices. Percy's (1986) study also attempted to impute rents in the B.C. forest industry to determine the success of rent capture by the provincial government, using a modified Copithorne approach based on valued added figures for the industry.

The identification of forestry economic rent and their taxation is an extremely vexing and complex problem. What makes forestry economic rents a unique and complex case for analysis is the complexities of timber resource allocation, utilization, and management . These complexities include the nature of tenure arrangements, regulations and the fact that forests, for the most part, are publicly owned resources where timber is not sold under competitive market conditions. Moreover, there is a confusing array of taxation mechanisms including, stumpage fees, reforestation fees, export taxes, area charges (example, holding and protection charges), and income taxes, which all have a direct or indirect role in the capture of a share of these forest rents. Other complexities include the fact that we are dealing with a renewable or sustainable resource characterized by lengthy rotation periods (40 to 100 years) (thus long investment periods for new timber capital), complex and often ambiguous property rights thus, complex tenure regulations and statutes. Furthermore, the forest is managed, in addition to timber, for non-timber resources, including wildlife, forest aesthetic values, and wilderness, which themselves have value and which further complicated the allocation and pricing of the timber resource. Other complications arise as the allocation and development of forest resources results in moving from a old-growth, unmanaged, stock resource state to a new-growth, managed, flow resource state. These make for peculiarities in taxation of forestry economic rents that in turn have an impact on how the resource should be managed and how firms view forest management investment.

A clear understanding of the treatment of forest economic rent is important because forests are publicly owned resources, and the government as steward and allocator, is in a position to exercise it's property rights and ensure social objectives are fulfilled and that the maximum benefits from resource allocation and use are realized. The role of government, as owner of the resource, usually includes: a) enforcing proprietary rights; b) ensuring the fair distribution or allocation of resources, as well as, ensuring regional community stability, economic development, and other broad social objectives are met; c) correcting for market failures (for example, in the absence of competitive stumpage markets) through the use of tenures, legislation, policies and regulations; d) ensuring that a fair return on investment in public resources is realized; e) achieving a stable economy and forest industry and encouraging investment; and ; f) ensuring that opportunity costs associated with non-timber resources that result from timber utilization are internalized through policies and regulations.

The issue of stumpage fees in Alberta has most recently become a focal point of public debate specifically as it relates to the tremendous expansion of the forest industry. (Edmonton Journal ,July 18, 1989 and September 27, 1989; Globe and Mail ,June 3, 1989; Calgary Herald , July 18, 1989; Alberta Report ,May 29, 1989; Red Deer Advocate ,July 14, 1989). Opposition to forestry development is often based on claims that rent capture by the Alberta government, through stumpage fees, is insufficient and may amount to a subsidy to firms or a wholesale give-away of the forests. It is important that an objective perspective of timber pricing, forestry taxation, and forest economic rents be maintained, not focusing exclusively on stumpage fees and other forestry charges alone but rather, taking a more comprehensive view of forestry rents taxation, which includes the role of corporate income taxes, municipal property taxes, and other forestry charges in rent collection. This assessment must be placed in the context of the explicit and implicit government objectives for resource development, allocation, and management.

C. Thesis Objective and Outline

The primary objective of this study is to examine the effectiveness of the Alberta government in economic rent collection on the basis of efficiency and equity criteria but also in the context of the legislation, policies and objectives of the government related to the development of Alberta's forestry sector.

A secondary objective of this study is to examine how taxation systems can be used to ensure that the quality and quantity of forest resources are sustained as we move from old-growth forests to new, managed forest ecosystems. This is an issue of sustainable development, an issue governments are attempting to understand in the context of resource management (World Commission on Environment and Development, 1989). Implementing the sustainable development principle, with respect to forest ecosystem management, is a challenging, if not illusive, goal. Part of the solution to implementation of sustainable development, as a paradigm or philosophy for resource management, lies in the correct pricing and valuation of natural resources and thus the correct determination and collection of resource rents. Achieving these goals will require tax systems that are sensitive to several other factors including, forest tenures, the security and regulations associated with them (Haley and Luckert ,1990), and encouraging firms to invest in intensive forest management activities (firms who may otherwise view such investments as marginal or without any secure future returns).

The thesis is composed of six chapters, including the introduction. The second chapter provides a theoretical overview of economic rent and resource rent taxation. The chapter consists of a synthesis of literature on economic rent, specifically related to forestry rents. It discusses the economic efficiency and distributional effects of government intervention in the forest base through resource rent collection. A full discussion of theoretical constructs of resource rent taxation mechanisms is also presented followed by a brief summary of their respective applications in the Canadian forestry context.

Chapter three describes the institutional framework of Alberta's forestry sector. This includes a brief overview of the forest resource base, the industry, and the economic value of forestry activity. A discussion of forest tenures and respective fee and charge structures is also provided followed by estimates of direct and indirect taxation of the Alberta forest industry. This provides some idea of the manner in which forest resource rents are being captured by government in Alberta.

Chapter four includes the estimates of forestry rents in Alberta. Two approaches are used to estimate rents: first, is the "residual valuation approach", and; second, the "value-added approach." The two terms have been coined for lack of a better definition. The residual valuation approach entails an analysis of conversion returns from the production of pulp and paper, lumber, and panelboard products. Conversion return values are imputed, using industry data, as the difference between the price of Alberta forest products less production costs (including labour costs), the opportunity cost of capital (including profit, risk, and depreciation). The value-added approach, used by both Copithorne (1979) and Percy (1986), takes a slightly different approach using Statistics Canada data to impute rents by taking the difference between value-added of total manufacturing activity, less the costs of labour, less the opportunity cost of capital (which again, includes profit, risk, and depreciation). The rents imputed using both approaches are then statistically compared to determine if there is any statistical relationship.

The fifth chapter discusses and a number of issues related to forest economic rents including : a) does the capture of less than maximum available rents by government constitute a subsidy to industry?; b) where do uncollected rents accrue?; c) treatment of forest resources as capital; and d) forest rents and silviculture investments, to name a few.

The sixth chapter provides some policy implications and recommendations. There are lessons to be learned about past timber pricing from which we can draw inferences for future pricing policies. It presents some options to be considered by policy makers in the Alberta government, options also suitable for other provincial governments. This chapter is followed by conclusions.

CHAPTER II

THE THEORY OF ECONOMIC RENT AND TAXATION

A. Economic Rent

Rent is defined by economists as the income earning capability or the productive value of a fixed factor of production (Manning and Adamowicz ,1989, p. 150). In the case of natural resources, resource economic rent is the surplus that remains after revenues from natural resource use have been disbursed to pay all costs of production, including a return on investment, or a "normal profit", equivalent to what could be earned in the next best use of the capital invested (Gunton and Richards, 1987). In the case of natural resources, resource rents are directly related to the scarcity and quality of these resources.

The existence of economic rent provides an important price signal for natural resources and for sunk-cost investments since rent values can serve as an indicator of the economic health of society and a signal for change in social structures. The existence of economic rent is the justification for several special forestry taxes (Boulter ,1984) such as stumpage fees, reforestation fees, yield taxes, and productivity taxes, as well as corporate income tax. Henry George, a turn of the century economist, contended that economic rent should be the sole source of government tax revenues.

Measuring economic rent is fraught with difficulties. Dovring (1987) notes that there is indeed a degree of arbitrariness involved when imputing rent especially when dealing with only one factor of production , such as forest land. Assessing the actual value of all factors of production or inputs and deciding which costs should be included is often difficult. It is also difficult, in the case of forestry, to distinguish total economic rent from rents generated from fixed factors of production, such as land, and from mobile factors, such as labour and capital (quasi-rents). Quasi-rents may be included in the total economic rent figure and thus considered available for taxation when in fact these quasi-rents arise from improperly treating mobile factors of production, like labour, as fixed.

Three types of economic rent can be distinguished: differential Ricardian rent, monopoly rent (or monopoly profit), and quasi-rent. Differential Ricardian rents arise from the productivity or quality of natural resources. Monopoly rents or market access rents arise from market power (Copithorne ,1979, p.45). For the purposes of this paper we will assume that government's, through use of legislation, policies and regulations, mitigate or eliminate market power that gives rise to monopoly rents.[2] Quasi-rents are rents derived from other fixed factors of production, other than land, such as capital. This paper will consider differential Ricardian rents and, to some degree, quasi-rents.

B. Differential Ricardian Rent

Differential Ricardian rent is synonymous with scarcity rent but more specifically it is a function of the scarcity and productive capacity of land. David Ricardo (1817) defined it as the difference between the productivity of the intra-marginal firm and that of a marginal firm. Differential rent is the economic surplus, the surplus of revenue over costs, accruing to the intra-marginal natural resource (Copithorne,1979, p.44). Therefore, on the marginal unit of forest land no rent would occur. Differential Ricardian rents arise from the inherent quality or productivity of natural resources and include locational rents that reflect costs of transportation. Given clear ownership, no externalities and the existence of perfect competitive factor and product markets, the market process would establish an efficient level of rent and thus an efficient extraction and consumption path along a marginal revenue curve where the resource owner receives the full differential Ricardian rent.

Figure 2.1 illustrates differential Ricardian rent. The diagram (Boulter ,1984, p.96-97) assumes a competitive market situation in which Pm is the market price for forest products and Qm is the market equilibrium quantity of production of a profit maximizing firm. Pm-Qm represents equilibrium, where supply equals demand. The differential Ricardian rent is equal to the area SPmB. The area 0SBQm is the cost of production. In the case of forestry, the supply curve can be considered both as the firm's marginal cost of production in utilizing old-growth, virgin forests, for example, or the government's cost of producing second-growth timber (Boulter ,1984).[3] The supply curve is the marginal or incremental cost of producing each individual unit of output and includes normal returns to capital and labour. It does not, however, include payments to the natural resource input, a key issue. Therefore, it is either intramarginal firms or intramarginal units of timber [4]that give rise to differential rents. Under perfect market conditions the differential Ricardian rent would accrue to the resource owner .

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[2] Monopoly rents present certain difficulties for measuring and capturing economic rent. There are two reasons which make this difficult: 1) most resources involve the production of joint products, such as lumber, chips, pulp and paper, so it is difficult to distinguish what portion of production costs should be attributed to each product, and; 2) it is already difficult to observe differential Ricardian rents because of incomplete information on production costs, forest product selling prices, and capital markets that are firm specific.

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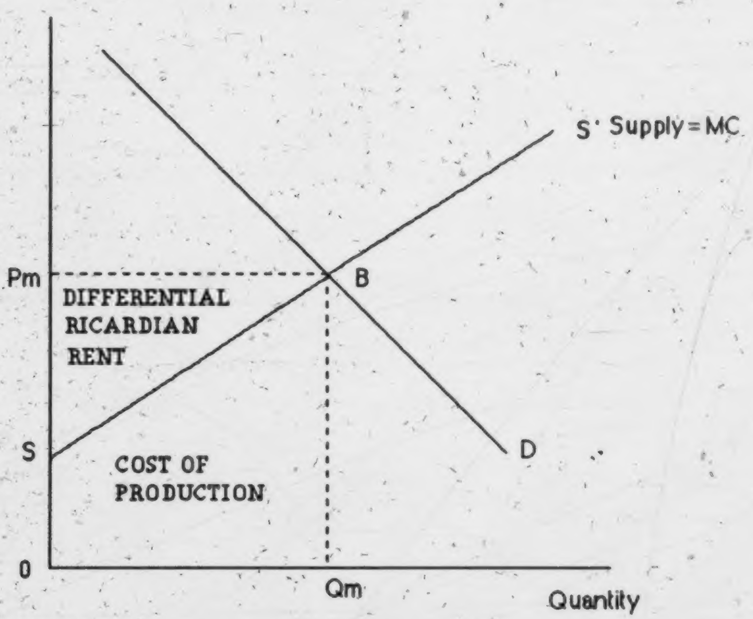
[3] It is important to remember that in furnishing old-growth timber for commercial use, governments incur no real marginal costs. Marginal costs of government are associated with establishment of new-growth, plantation forests that include costs of timber stock establishment and stand tending.

[4] It should be noted that because intramarginal units of timber give rise to economic rent and thus can be taxed or collected implies that marginal resources or marginal units of forest land receive zero levels of taxation.

Diagram 2.1. Differential Ricardian Rent



What the diagram shows is the fact that provincial governments regulate or control the allocation of timber supplies through establishment of annual allowable cuts which can ultimately constrain the firm in the production of Qm of timber. This has important implications for the input costs firms face and other shadow costs of regulations. Because governments have direct over the allocation and pricing of timber, the major factor of production, implies that perfectly competitive markets may not exist and that governments attempt to simulate or replicate market conditions through stumpage pricing and other regulations. The implications of this government behavior as an oligopolist on economic rent will be explored later.

C. Quasi Rents

Alfred Marshall (1890) distinguished pure "rents" for land and "quasi-rents", that is, income derived from any other fixed factors of production other than land, such as machinery and other fixed factors of production.[5] Quasi-rents arise out of the distinction between short (variable) and long run (capital) costs. Quasi-rents exist when other factors of production such as land, capital and even labour [6]are treated as fixed in the same way as land (Dovring ,1987). In the short run, it is tempting to view economic rent based solely on the difference between product price and variable costs of production. In the short run, capital is generally immobile and, in the long run, capital is mobile and will move to the next best market opportunity. Therefore, in the long run, the market price must be sufficient to cover both short run, variable or operating costs and the long run, replacement costs of capital. Quasi-rents result when capital is treated like other production costs and included in the economic surplus from production (economic surplus is the difference between price of forest products and variable costs of production) . They provide important market entry and exit signals to firms considering alternative investment opportunities.

While some economists have lumped quasi-rents in with differential rent generated from land (see Manning and Adamowicz ,1989) there may be reason to distinguish these in the case of forestry. The recognition that quasi-rents, in fact, make up a part of the total economic rent generated from the forest land base is critical in the application of rent theory to forestry. Percy (1986) noted in his study of the British Columbia forestry sector that quasi-rents may in fact make up a portion of rents generated by forest industry activity, however, they can be difficult to measure. Copithorne (1979) also noted that labour union power in British Columbia's forest industry may in fact be generating quasi-rents and thus capturing part of the total economic rent generated from forestry activity. This would support the notion that labour has become semi-fixed because of the inelasticity of supply for skilled labour.

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[5] According to Manning and Adamowicz (1989) economists later applied the term economic rent to both land and other rent earning factors of production. For purposes of this paper the uniqueness of quasi-rents will be retained applying it to rents from all other factors other than land So to, differential rents will apply specifically to rents from land, in our case forested lands.

[6] Dovring (1987) suggests that labour can acquire quasi-rents to the extent that the supply for skilled labour has become more inelastic.

Figure 2.2 Quasi-rents

Figure 2.2 Quasi-rents removed due to copyright restrictions

Figure 2.2 (Gunton and Richards eds.,1987) illustrates quasi-rents. This diagram shows a firm which has experienced a windfall increase in demand where the price per unit of forest product equals uP. VV' is the average variable (i.e. operating) cost per unit of output and VS' is the short run marginal cost or supply curve. The average total cost per unit of output is indicated by TT' which represents the sum of average variable costs plus the average capital costs. The firm maximizes profits in the short run at production level Qo where the price equals market price for the forest product. The hatched area APCB is windfall profits the firm realizes at price of forest products at P. The shaded area BCED is quasi-rent that is generated from the use of capital. It is this quasi-rent that is required in the short term to provide for payments to investments in capital costs.

Lumping quasi-rents into total economic rent and then taxing part or all of the quasi-rent component can, in the short term, have a negative impact on a firm's investment behavior because it impedes the signals necessary to induce new investment in the industry. It is important that economic rent taxation or resource pricing mechanisms recognize the existence of these quasi-rents, the impact of taxing them, and ensure pricing structures are sensitive to leaving quasi-rents available to firms for future investment opportunities. Quasi-rents tend only to be affected under administered timber pricing (stumpage) formulas because there is tendency to build in an estimate of the shadow price for capital (i.e. a proxy for capital costs).

D. The Theory of Forest Economic Rent Collection by Governments

Provincial governments, as owners of the forest land base, are faced with establishing an efficient resource pricing structure and the collection of natural resource rents to ensure highest value of use. This is the duality of allocative efficiency and distributional equity. Efficiency in allocation of resources is achieved, in part, through proper resource pricing, to ensure that resources are allocated to their highest value of use and to ensure that their relative scarcity is reflected by these prices. Distributional equity is achieved through rent collection and pricing to ensure the efficient and equitable use of the forest resources so as to maximize the benefits to society.

Governments use a number of fiscal taxation devices to collect economic rents or returns generated from the utilization of publicly owned timber resources. Each province in Canada uses a variety of taxes and levies to collect the share of economic rents that are generated as a result of the services timber utilization provides. In the purest sense, governments are interested in the collection of economic rents generated by the intra-marginal unit of forest land or timber. These include stumpage fees, holding and protection charges, corporate income taxes, and a variety of other taxes and levies.

The collection of economic rents by governments can have important distributional and efficiency effects, the consequences of which governments must consider prudently. When governments design taxation systems they are interested in achieving three microeconomic criteria or goals: neutrality, equity, and simplicity (Pearse, 1990).

A tax is considered neutral if it does not distort the allocation of resources, the efficiency of resource use, nor changes the firms utilization behavior (Boadway, et. al. ,1982). Neutrality may be considered synonymous with efficiency. Boadway et al (1982) consider neutrality to be the most important criterion in the design of taxation systems. A neutral tax system only impinges on intra-marginal investments or in the case of taxation of timber, on the intra-marginal timber supply. A neutral tax is one that applies no burden (zero tax) on the marginal unit of timber. A truly neutral tax system should allow firms to invest in the most economically efficient manner. A non- neutral tax will distort the investment decisions of firms that lead to inefficiencies in resource utilization and allocation of factors of production.

The second goal, that of achieving equity, relates to the distribution of income from the firm to the government. The distribution of income and property rights is at the heart of most resource taxation policies. The primary goal of any taxation system is to generate revenues for the government treasury by collecting a certain percentage of the economic rents generated from resource utilization. However, industry will invest in factors of production only when it expects sufficient returns on its investment, thus, government tax policies need to sufficiently equitable and sensitive to this investment climate.

A third goal of a taxation system is that they be simple and easy to administer. Fiscal taxation devices which are both efficient in economic rent capture and yet easy and cost effective to administer are the most desirable from a government's perspective.

In addition to these microeconomic criteria or objectives, governments have macroeconomic objectives. These include, stable income or revenue flows to the provincial treasury and compatibility with the growth in the economy (Boadway, et al ,1982). A consistent and stable flow of tax revenues is critical for government's in exercising their fiscal policies. A tax system which attempts to capture the maximum amount of rent at a high administrative cost may be less desirable than one which captures less total rent but provides stable revenue flows with lower administrative costs. Stability in resource pricing is equally important to firms who are faced with considerable variability in forest product market prices.

Governments may also adopt a taxation system that compliments economic development policies or growth objectives. For example, tax systems may be designed to provide incentives for regional development and employment generation. Tax policies may also be chosen to encourage or support investment in value-added industries or greater downstream processing. Other fiscal policy considerations include employment generation and alleviating regional disparities. It may also be desirable to ensure healthy levels of profitability and investment in the forest industry by adopting less than maximum rent collection tax policies.

Finally, depending on how taxation is imposed, the distribution of risk and uncertainty associated with forestry activity is an issue. The distribution of risk can be shifted through the tax system. The distribution of risk is particularly important for forestry where uncertainty can exist as to long-term security of the quantity and quality of timber supplies and as to whether or not returns from investment in future timber supplies will be realized in the future. Taxation systems could be effectively used as a means of ensuring that the risk of investment is shared equitably between government and industry.

E. Efficiency and Distributional Effects of Government Intervention in the Forest Base.

E.1 Introduction

The forest industry, like other resource industries, is an important source of economic rent and their collection provides an important source of tax revenue for governments. Economists, including Boadway and Mintz (1988), Heaps and Helliwell (1983), and Boadway, McKenzie and Mintz (1982), would argue that taxation of economic rents can be done both in an efficient and equitable manner, providing a relatively neutral mechanisms for ensuring the benefits (and thus value)of a nation's or province's natural resource endowments are realized.[7] While governments ideally seek neutral tax structures,economists have recognized that the manner in which provincial governments tax resource rents is extremely inefficient because the tax base often differs considerably from the actual resource rents generated (see Boadway and Mintz (1988)).

Helliwell (1982) suggests three broad issues related to resource taxation: a) the place of resource taxation in the system of taxation as a whole; b) the division of tax powers and revenues between governments, and; c) the alternative methods of resource taxation including broader instruments than just taxes and royalties. This paper will concentrate primarily on issues a and c.

Dasgupta and Pearse (1974) and Mishan (1975) noted that rent collection can have important income distribution effects that cause shifts in the relative demand for different goods, change relative prices of commodities, and therefore alter the definition of an efficient outcome. Gunton and Richards (1987) argued that aggressive, efficient rent collection by government may in fact result in more efficient rent generation by the industry. They argued that failure to collect enough rents from industry may result in "X-inefficiencies " in production and "allocative inefficiencies." These inefficiencies are the result of distortions in prices and the firm's production decisions because of the government's inappropriate appraisal of resource rents, as reflected in forestry taxation policies.

Anderson (1987) provides an alternative theoretical hypothesis to the rent maximization argument of Gunton and Richards, suggesting that there is a threshold for optimum rent collection and that as governments pursue collection of total available rents (up to one hundred per cent) there are diminishing total economic rents because inadequate levels of economic surplus are left for firms to optimize during production.

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[7] Let us assume that the primary goal of governments in collecting forestry economic rent through taxation is to ensure efficient and equitable use of resources so as to maximize the social welfare of society. However, as Cairns (1982) notes, while the purpose of resource taxation is generally considered to meet these efficiency and distribution criteria, resource taxation encompasses part of natural resource management. This issue will be discussed further on in the paper with respect to the relationship between taxation of rents and forest management and forest tenures.

There has been relatively little Canadian resource economic literature (both empirical and theoretical) that encompasses the full picture of forestry rents, rent collection through taxation and the impact of taxation on rents. The exceptions are Baker (1990), Gunton and Richards (1987), Percy (1986), Boulter (1984), Helliwell and Heaps (1983), White (1983), Copithorne (1979), and Howard (1978). There have been no published studies of forestry rent and taxation for Alberta. Most of the forestry economics literature has focused primarily on only one aspect of forest resource rent collection, that is, on the use of stumpage pricing or charges applied on the harvested volume of timber (Uhler ,1987; Schwindt ,1987; Heaps ,1985; Haley ,1980; Nautiyal,1980; Nautiyal and Fowler ,1980; Nautiyal and Love ,1971). Boulter (1984) suggested that royalty taxes, such as stumpage fees, currently play a minor role (in terms of magnitude of tax revenues) in capturing resource rents compared to income-based taxes, that is, corporate income taxes.

There are generally three categories of resource rent taxes: 1) royalty taxes (including stumpage and yield taxes); 2) income-based taxes (including corporate income tax); and 3) lump-sum taxes (including property taxes).

E.2 Royalties, Stumpage Charges, and Yield Taxes

This classification of rent taxes can be defined as a resource-based tax which is a levy or price on the unit of resource extracted and is based on the imputed value of that resource. In this sense, resource-based taxes are a proxy for the value or price of the resource.This group includes royalties, stumpage charges, cutting fees[8], and yield taxes.

E.2.1 Royalties

A royalty is typically a levy or tax on the volume of extracted resources or, in the case of forestry,on the volume or value of timber harvested. A royalty (or stumpage charge [9]in the case

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[9] Stumpage pricing or charges will be dealt with separate from royalties even though they are a form of royalty and have similar efficiency and distributional effects. Treating them separately is warranted

of forestry) is a purchaser's payment for a commodity, that is timber (Pearse 1990). Royalty-type taxes have one thing in common, that is, they are based on a fixed dollar levy on units of timber harvested and therefore have similar efficiency and distributional effects.

According to the definition of a tax, royalties are not true taxes ,rather, they are levies on the price payable on the quantity or volume of resource extracted. As Pearse notes, "a tax is always a government levy that expropriates, for the public purse, a portion of private wealth or income" (Pearse, 1990, p.200). Royalties are flow-type payments levied on a per unit of resource extracted or value of production.

The major disadvantage of a royalty is that it amounts to a variable input cost of production [10] to firms and thus using royalties to capture economic rent will ultimately impact upon the quantity of rent generated and affect the normal returns to factors of production. This can discourage investment and create other production distortions. Royalties cause distributional effects by shifting economic surplus from timber utilization from the producer to the government. Royalties can "also affect the economic efficiency and allocation of resources in harvesting by making it unprofitable for the owner to harvest marginal stands of timber and recover marginal logs "(Pearse, 1990, p.201). It thus imposes a tax at the extensive margin of resource extraction thus discouraging utilization of the marginal unit of a resource. Only a marginal royalty tax structure (Livernois, 1990), that is, a levy on a percentage of the net value of timber (Pearse ,1990) that imposes no levy on the marginal unit of a resource, would meet the neutral tax criteria. This would require imposing a zero tax rate on the marginal unit of resource extracted at the extensive margin providing firms greater incentive to use these marginal units of the timber resource. If royalty systems of taxation are not sensitive to the profit structure of firms it could either discourage development in the highest cost case or induce premature abandonment (Bradley et.al., 1981).

On the positive side, the distortions typical of royalties may be mitigated if they are based

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because stumpage pricing has sufficiently unique characteristics and it is the most identifiable means of economic rent collection in the forestry sector.

[10] Nautiyal (1980) notes that stumpage or royalties based on a per unit of volume of timber harvested tend to exaggerate the monopoly effects of the firm by increasing the firms variable costs instead of its fixed costs.

on the net value or differential economic rent of the resource rather than on volume. One of the advantages of royalties is their ease in administration, however, as in the case of stumpage pricing in provinces such as British Columbia they are becoming increasingly administratively complex (Boulter ,1984).

E.2.2 Stumpage pricing or charges

Stumpage pricing or charges are a form of royalty or resource-based tax applied in the forestry sector on the timber harvested. However, they tend to be more discriminating than royalties (Pearse, 1990) because they are often designed with the intent of timber pricing and capturing all or a large share of the economic rents generated by each unit of timber harvested. Stumpage price refers to the price of timber on the stump and thus is a proxy for the value of timber. Stumpage pricing is typically a more comprehensive means of economic rent collection than a simple royalty. In some provinces (notably British Columbia) stumpage pricing has evolved to such a degree that it could potentially serve as the single most important instrument of taxation in the collection of resource rents generated from forestry activity.

Because stumpage charges are similar to royalties, they may also have similar efficiency and distributional effects. Because they are levied on the volume or value of timber harvested, they tend to tilt the production path of the firm by reducing initial output; referred to as the "cut-off grade" problem (Helliwell and Heaps, 1983)[11]. The cut-off grade problem, that is, the impact on the marginal resource unit, is illustrated in figure 2.3 where the imposition of a volume-based royalty on all qualities of logs induces a firm to become less efficient in resource use, refraining from harvesting lower, marginal quality logs and instead opting for higher quality logs (or high-grading). Stumpage charges are an inefficient means of collecting economic rent because they result in marginal units of timber becoming unprofitable .

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[11] Helliwell and Heaps (1983) indicate that,while the theoretical impact of royalties on the timing of production or harvesting has been developed, the efficiency consequences have not been empirically studied.

Figures 2.3. Effect of stumpage charges (royalty tax) on harvesting at the extensive margin.

Figure 2.3 removed due to copyright restrictions

Source: Pearse (1990), p. 201.

Sandhu and Phillips(1989) have shown that under imperfect stumpage market conditions, optimum rotation periods decrease as the real price of stumpage grows exponentially. If the demand for stumpage increases in subsequent periods, then optimum rotation periods become longer.

Because stumpage pricing is often used as the primary mechanism for collecting a share of economic rents it is important to recognize that there may be both *ex ante* and *ex post* economic rent collection occurring through stumpage pricing and collection policies. Rents can be collected in an *ex ante* fashion, that is before actual harvesting or utilization, through the use auctions for timber where stumpage prices are established through a bidding process. *Ex ante* rent collection tends to capture "quality-type" rents (Boulter, 1984). When stumpage is priced in this fashion it provides timely information about a firms willingness to pay for timber reflecting a value judgement about it's relative scarcity. *Ex ante* means of rent transfer are in theory efficient and equitable but only so long as information markets are perfect and competition is intense (Gunton and Richards, 1987). Part of the difficulty with *ex ante* rent collection through bidding is that they are impossible to apply under conditions of high corporate concentration and are limited to situations where resources have not already been allocated. In addition, competitive bidding is only effective under conditions of stable public policy. Because of incomplete information. markets and inadequate competition in stumpage markets,*ex ante* rent collection through competitive auctions have not been widely applied by provincial governments. Rents collected in an *ex post* fashion, or after the harvest and utilization of timber, refers to all other forms of resource taxation including stumpage charges and other forestry charges (as well as corporate income taxes).

Most provincial governments establish stumpage prices using some form of appraisal of the value of timber. Because stumpage pricing or charges are typically levied on the net value of timber they can , in theory and unlike a royalty, be designed to capture all or a portion of differential rents without distorting the extensive margin. [12]

Pearse (1990) and Percy (1986) note that , stumpage prices which are established prior to timber harvesting and thus payable on a lump-sum basis based on the assessed value of the timber , do not, in theory, distort the economic behavior of the firm. This is because when stumpage prices are paid up front they are considered fixed or sunk costs and, therefore, do not affect the firms production decisions at the extensive margin. Pearse suggests that "assessments of standing timber are preferable on grounds of neutrality" (Pearse, 1990, p. 205). He contrasts this approach to stumpage pricing where charges are set based on the average net value of standing timber and applied uniformly on the actual timber volume harvested. This will cause the same distortions at the extensive margin as a royalty because it imposes a costs on these marginal units thus making it unprofitable to harvest. Governments that adopt this approach for rent collection run the risk of providing incentives to firms to "high-grade" timber during harvesting. Governments restrict this tendency by imposing harvesting regulations. Pearse concludes that "stumpage charges levied on the logs recovered from the forest, in contrast to assessments on the standing timber allocated for harvesting, constrains the intensive and extensive margins of profitable operations, resulting in waste of potentially valuable timber" (Pearse, 1990,p.205).

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[12] However, in practice provincial governments still apply an upset or minimum stumpage price or charge on the marginal units of timber therefore resulting in the same efficiency distortions described in the royalty section.

E.2.3 Yield Taxes

Yield taxes are government levies applied to the volume of timber cut on private forest lands at the end of a forest rotation period (Pearse, 1990). These are *ad valorem* taxes, based on a percentage of either the selling price of timber (that is, the gross value of the timber harvested) or the stumpage value (that is, the net value of the timber harvested). Boulter (1984) suggests that yield taxes are an income-based tax which impose a levy on timber harvested at the end of a rotation period. Taxation is thus deferred, reducing the current tax load, and minimizing the impact on a firm's cash flow. .

Helliwell and Heaps (1983) found that ad valorem yield taxes have three beneficial characteristics that is: 1) they increase the forest rotation from the private owner's optimum to one that maximizes social benefits (in some cases may defer commercial harvest indefinitely (; 2) they are not based on future product prices (rather on timber values at the time of harvest) so that any future gains or losses are shared between private land owners and the government; 3) they could in fact increase the supply of timber; and 4) are easy to calculate relative to other taxes. Klemperer (1976) found that, for regulated forests, yield taxes had the least distortional effect on forest land values of several other taxes examined. Yield taxes may also reduce the problem of causing distortions at the extensive margin if applied as a percentage of the net value of the timber. Yield taxes may also be seen as an alternative to property taxes on timber. As Pearse (1990, p. 203) notes, they "have the advantage of avoiding the accumulation of payments and interest on payments as the forest grows, with the resulting financial disincentives to carrying crops."

The disadvantages of yield taxes include their administrative complexity (Pearse, 1990) because they require information about the quantity of timber harvested from private lands and about its market value. Tax revenue flows also tend to be highly unstable due to fluctuating market cycles, a quality not necessarily desirable for government fiscal policy. In addition, necessary risk sharing between the municipal government and the firm may be undesirable for local governments (Boulter, 1984). Yield taxes impose some distortions similar to royalties, the main distinction being that a yield tax reduces the gross value of timber by a constant proportion rather than a fixed dollar amount (Pearse, 1990).

E.3 Income-based Taxation

An income-based tax is a tax on the income or profits generated from the production of forest products, after production costs and depreciation allowances are netted out. In determining taxable income, resource-based taxes and charges are treated as costs of production. Baker (1989) and Boulter (1984) suggest that income-based taxes [13](including corporate, business, investment, and capital gains taxes) are important to the Canadian forest sector because they can affect every aspect of production, forest management, and investment.

E.3.1 Corporate Income Tax

Boadway and McKenzie (1988) and Boadway, Bruce and Mintz (1982) suggest that the most important income-based tax used in resource industries is the corporate income tax. [14] This is particularly true for the forest industry (Baker,1990, and Boulter, 1984). A corporate income tax is a tax applied by federal and provincial[15] governments on an accrual basis on the corporate or business income of both corporations and individuals (Boadway and McKenzie, 1988). Common to most corporate income tax structures is the allowance for deductions of production expenses, interest income, and historical capital cost depreciation in determining taxable income (Helliwell and Heaps, 1983). Capital expenditures are also deductible over a phased or lag time period based on depreciation rates in accordance with inflationary trends and accounting principles. In effect the corporate income tax is a tax on economic rent plus a "normal" return on capital (Helliwell and Heaps, 1983).

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[13] The term profit tax is often mentioned in the tax literature which may lead to some confusion over the difference between this tax and income taxes. Fundamentally, a profit tax is a tax levied at the time of harvest or resource extraction as a portion of the net value of timber. Because they use a tax base equivalent to the net value of timber or a resource they can be similar to an income tax or stumpage pricing structures that are based on an appraised net value of timber at the time of harvest.

[14] The corporate income tax structure was revised by the federal government in 1987, though many of the arguments made here still hold. In general terms, these revisions involved a reduction in the corporate

In theory a corporate income tax is non-distortional because it collects rent in an *ex post* fashion after production has occurred. It should, therefore, not impose the same distortions to the extensive nor intensive margin in forestry that stumpage pricing and royalties may impose. Fundamentally, corporate income taxes collect residual or differential rents that have not otherwise been captured through stumpage pricing or other charges.

Some authors (Boadway, Bruce and Mintz , 1982, p. 171) suggest that the current corporate tax systems only pays "lip service" to it's role in the collection of rents for governments because it does not recognize all production costs, including capital costs, associated with resource-based industries. Stiglitz (1973) noted that a corporate income tax is ultimately a tax on capital income rather than a tax on rents or pure profits. While corporate income taxes pose less limitations to investment than other tax systems, they do not distinguish between normal profits (returns to capital) and economic rent and thus are unable to capture a large proportion of economic rent from intra-marginal sites without discouraging marginal production (Cairns ,1985). Finally, under a high tax rate regime, these taxes tend to provide incentives for firms to transfer economic rent to non-taxable areas of production.

Boulter (1984) and Baker (1990) provide important insight into the impact of corporate

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income tax rate on manufacturing activity with offsetting reductions in tax credits.

[15] Only Alberta, Ontario, and Quebec currently collect corporate income tax in concert with federal government collection.

taxation on the Canadian forest industry. Their studies suggest that the forest industry does not receive preferential treatment *vis-a-vis* other manufacturing industries. Many of the tax incentives available to the forestry industry are also available to other manufacturing sectors including: a) preferential tax rates for small businesses and manufacturing processing activity; b) accelerated capital cost allowances for private property used for wood utilization facilities; c) investment tax credits, and; d) research and development expenditure deductions. According to these studies, the current income tax system has no significant negative impact on private sector investment in forestry on public lands because the current production costs, including the stumpage charges and other costs of forest management, are deductible against income. In essence, the costs and risks of growing timber are shared between firms and the government.

Baker and Boulter have noted some shortcomings of the corporate tax system. First, the tax system does not recognize the long periods required to grow timber and may treat investments in forest management inequitably *vis-a-vis* other renewable resource sectors. To this extent, there is an absence of an equity claim for the firm to the future timber crops and the current tax structure does little to encourage increased expenditures in intensive forest management. Second, Boulter claims that tax incentives favour capital spending over labour spending through investment credits or accelerated capital cost allowances; despite the fact that forest management investments are labour intensive and that there is no clear evidence that the treatment of capital in this fashion is desirable or neutral in the long run allocation and efficient use of resources and factors of production. Third, Boulter argues that the current tax regime may distort investment decisions of firms because it tends to favour an even-aged forest regime over an uneven-aged or mixed-wood forest regime. Fourth, Baker notes that the right to harvest and utilize timber is generally treated as capital property and thus may increase the profits of firms but do not necessarily provide incentives for forest management investment. Fifth, Baker suggest that the tax system is distorted because it makes a distinction between timber harvested sporadically and timber harvested on a regular scheduled (sustained yield) basis. Timber cut sporadically is treated as a capital gain and taxed at a lower rate while, timber cut on a scheduled or AAC (annual allowable cut) basis is treated as normal income flows and taxed at a higher rate than capital. Baker concludes that the result is the unintentional discouragement of sustained yield forest practices. This scenario would only seem to hold true in the case of private forest lands because land owners can harvest timber at their own discretion and because timber harvesting on public forest land management requires strict adherence to AACs and sustained yield policies enforced by governments.

E.3.2 Cash Flow Tax

Boadway, Bruce and Mintz (1982) noted that a neutral, or efficient corporate income tax can be designed that will capture rents or pure profits [16] and not interfere with the efficient allocation of and investment in resources. Such a neutral income tax would only be neutral if it falls on the pure profits, cash flows, or rents generated from the intra-marginal unit of production. A cash-flow tax is an income-based tax where the tax base is the cash flow of a firm. Of the three tax categories examined in this paper, only cash-flow taxes and lump-sum taxes taxes have been found to be relatively non-distortional to production, investment and pricing decisions of firms (Livernois, 1990; Gamponia and Mendelsohn ,1985; Gaudet and Lasserre ,1986; Heaps and Helliwell ,1985; Boadway, Bruce and Mintz, 1982, Garnaut and Clunies-Ross ,1975).

The cash flow tax is an alternative to the corporate income tax where governments consider the cash flows of each individual firm in each specific year of operations as the tax base. The cash flow tax base is established by an explicit accounting of revenues generated from manufacturing resource-based goods less the current (marginal) and capital costs (fixed). Thus the tax allows for the deduction of all investment costs against income at the time they occur. It is designed to transfer a specified share of the present value of economic rent over a project's life from the firm to the resource owner. A cash flow tax works by levying a fixed tax rate (example, 50 percent) on the net present value or discounted net revenue flows (both positive and negative).

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[16] In a sense the term "pure profits" is synonymous with rent but it is specifically that rent that is generated in the production process (Boadway, Bruce and Mintz, 1982)

This involves the amortization of capital expenditures over time by a pre-established rate of return on capital as the discount rate. Therefore, both firms and government share in the risk of a resource development project. It requires that governments share in the risk by absorbing the initial negative cash flows (through transfer payments to firms) that occur in the initial stages of a project's operations.

Livernois (1990), Boadway, Bruce and Mintz (1982), and Garnaut and Clunies-Ross (1975) and other advocates of a cash flow tax suggested that current corporate income tax structure could either be modified to reflect the imputed incomes of firms or completely replaced by a cash flow based tax that would be neutral. In either case , the same amount of tax revenue would be generated. There are several noted advantages of a cash flow tax including: a) cash flows are readily observable; b) they treat capital expenditures as well as a current or marginal costs as deductible at the time they occur making it unnecessary to determine the actual costs of equity, debt financing, and depreciation rates; c) they are simple and easy to administer; and d) they cause fewer distortions to a firm's investment behavior than other income taxes because it is symmetrically applied to both negative and positive cash flows.[17] It is considered a neutral tax because only economic rents enter the tax base (Livernois ,1990). A cash flow tax in theory avoids the distortions to output and resource use at the extensive margin, common to other forms of taxation, by applying a tax only on profits (that has netted out a normal return to capital) or only on the rents generated by intramarginal resource use.

There are, however, some limitations. Large negative tax liabilities can arise because of negative cash flows. When governments share these liabilities and risks with industry, such taxation policies may become economically and politically unattractive. Second, government(s) may be risk averse to sharing in the front-end investment risk of projects (Kemp,1987). Third, while in theory a cash flow tax is non-distortional the neutrality principle can be violated in practice because of the difficulties in imputing a firm's economic cost of capital and the firm's discount rate, and ensuring that this rate equals the interest rate used in the present value calculations. If a "normal" discount rate is set too low, investment may be discouraged (Olewiler,1978). Some other disadvantages include : a) tax revenues may be inconsistent (that is too variable) or insufficient in meeting government revenue objectives; b) it may not be an equitable tax because it "does not distinguish between taxpayers on the basis of their ability to pay" because a "pure profits (rent) tax does not distinguish between taxpayers on the basis of income or expenditure" (Ballentine, 1982, p213); c) a cash flow tax cannot be invoked without concurrently making changes to personal income taxation so that dividend income to stockholders would not go untaxed (Ballentine, 1982); and d) it provides producers little incentive to be efficient and innovative because the costs of inefficiency can be passed on to governments in the form of lower tax payments.

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[17] Personal communication with Dr. John Livernois, University of Alberta, December 5, 1990.

In theory, such a tax could replace all other forms of resource rent collection means because it would capture the full extent of economic rents generated from resource extraction activity and thus comes closest to a neutral tax for rent collection.

E.3:3 Resource Rent Tax

The Resource Rent Tax (RRT) is a modification of the cash flow tax, a concept developed by Garnaut and Clunies-Ross (1975). Like the cash flow tax, the RRT is an income or profits tax designed to transfer a specified fraction of the present value of economic rent over a projects life from the firm to the resource owner. It differs from a cash flow tax in that it levies a resource rent tax on the discounted net revenue flows only after cash flows are positive or sufficient to cover production costs, including a sufficient rate of return on capital invested.

On the positive side, it provides firms the opportunity to defer negative cash flows during the initial capital investment period to future periods when cash flows become positive. This is an improvement over the cash flow tax. It also relieves governments from making payments to firms during the initial negative cash flow stages of a project and provides for a more consistent tax revenue stream. It nevertheless exhibits some of the other advantages and disadvantages common to the cash flow tax.

The potential application of a RRT or cash flow tax to Canada's forest industry would require the reform of all other tax systems used in the forestry sector. It would essentially replace corporate income taxes, stumpage charges, and all other forms of rent capture devices currently used and be the sole means of rent collection. Such a scenario while economically optimal is unlikely to transpire because, as Livernois [18] suggests, governments have a vested interest in maintaining control over taxation at jurisdictional levels. The best that could be hoped for is a retention of the corporate income tax with modifications to stumpage pricing to take on characteristics of an RRT or quasi-royalty based tax. The other reasons an RRT may not be readily adapted is because the current tax regime is already incredibly complex thus, it would be impossible to make changes without disturbing the vested interests of both government and industry [19](in the form of tax credits, allowances, and other tax exemptions) .

E.4 Lump-sum Taxes

Lump-sum taxes are the least distortional of the three categories of taxation because they are levied as a fixed proportion of the pure economic rent thus do not have the same distortional effects of a per unit levy. Lump-sum levies generally apply to the rights to access and extract resources. Examples of lump-sum taxes include property taxes, productivity taxes, yield taxes, and lease fees. In comparing lump-sum taxes, Gamponia and Mendelsohn (1985) have shown that yield taxes tend to outperform property taxes. Lease fees are lump-sum levies on the property rights of holding public resources.

There are noted disadvantages to lump-sum taxes. Jenkins (1977) notes the effects of lease fees are similar to property taxes because they increase the rate of extraction, discourage exploitation of marginal resources, and fail to capture significant rent on intra-marginal sites.

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[18] ibid Livernois (1990), see footnote 28

[19] These interests for industry include tax credits, capital cost allowances, and other tax exemptions.

E.5 Summary of Resource Rent Tax Applications

What is generally observed in the collection of forestry rents from publicly owned timber resources in Canada is a mix of tax policies conducive to the respective institutional, policy, and resource base context of each jurisdiction. Where the resource base is at the extensive margin and heterogeneous, we see more complex forms of rent collection which reflect the relative values of timber resources. In most jurisdictions, we observe the application of a flat rate royalty or stumpage structure applied through administrative stumpage pricing by government.

Baker (1990) and Boulter (1987) both assessed the various tax regimes for the Canadian forestry sector at all three levels of government (federal, provincial and municipal) and found that while resource-based taxes (eg., stumpage fees) have been the most visible means of rent collection, in fact, it is corporate income taxes and property taxes that have played a more critical role in rent collection. Most provincial governments have used a combination of stumpage pricing or taxes on harvest and corporate income taxes to appropriate rent to the Crown (Uhler, 1987). Some provincial government forestry agencies may consider stumpage pricing as a means of generating resource taxation revenues to cover the Crown's costs (marginal) of forest management, while the role of corporate income tax may be expected to collect any residual rents that remain after resource taxation.

Virtually all forestry rent collection occurs in an *ex post* fashion through the application of stumpage pricing, income-based taxes, and lump-sum taxes. Alberta and British Columbia represent the few provinces who have adopted an *ex ante* rent collection systems. In Alberta, this is through competitive bonus bidding on some timber quota tenure sales and combined with *ex post* rent collection taxation mechanisms, including stumpage charges. In British Columbia, the Small Business Enterprise Program has given rise to the establishment of competitive auctions for timber stumpage.

Most governments have opted for *ex post* rent collection through administratively set stumpage pricing and other forestry charges. Most stumpage charges in Canada are levied as a charge per unit of timber harvested. This approach to stumpage price and rent collection may be administratively less complex and costly than competitive auctions and they may relieve governments from having to make complex management decisions in the absence of competitive stumpage markets.[20]

In British Columbia [21]and the U.S. stumpage pricing has developed into a complex appraisal of the conversion return, net value, or differential rent derived from timber production. Conversion returns are calculated as the difference between the selling price of forest products derived from the timber harvested less the variable costs of production including, harvesting (delivered wood costs) , production (manufacturing), and transportation costs. Usually built into this calculation is an allowance for profit and risk that reflects appropriate returns to capital investments. Conceptually, the conversion return is synonymous with differential Ricardian rent, thus, an accurate derivation of this conversion returns should provide a means of efficiently and equitably collecting economic rents from the forest industry. However, because such appraisals can be information intensive, complex , and costly to administer they may lead to distortions. Livernois (1990) has noted, because economic rents cannot be correctly observed by governments, even the most effective appraisal systems can still lead to the distortionary effects inherent to royalties. Such appraisals can also be criticized because they require value judgements about profit and risk allowances, depreciation , and adequate returns to capital (Pearse, 1990).

In other provinces, including Alberta, stumpage prices are usually administratively set according to the explicit or implicit policies of the government and resource management agencies. Some stumpage pricing structures use forest product price indices to adjust stumpage charges through time. Adjustments may also be made to account for variations in the firm's or industry operating conditions.

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[20] It should not be forgotten that governments act as monopolist suppliers of timber and thus can ultimately control stumpage markets.

[21] British Columbia's stumpage pricing system prior to October 1987 used an appraisal approach to determining stumpage charges, however, since then they have adopted a tax revenue targeting approach (where resource tax revenue targets are set by cabinet) using a valuation or appraisal approach upon which these targets are, in part, established.

Overall, while stumpage pricing systems could be designed to be neutral , they rarely are in practice because of a number or extenuating circumstances that hinder achieving such optimal tax structures. In general, most current stumpage pricing policies have similar impacts, that is, over- pricing or taxing timber at the extensive margin (least valuable timber) and under- pricing or taxing at the intensive margin (most valuable timber).

Yield taxes have not been widely applied in North America (Pearse, 1990) nor are they particularly relevant to public timber resources.

In the case of corporate income tax policies, in 1987 the federal government introduced a corporate income tax reform that would be phased in and completed in 1991. The overall predicted impact of this tax reform on the Canadian forestry sector amounts to a reduction in the federal corporate income tax rate [22] combined with a reduction in investment tax credits and capital cost allowances. Baker (1989) suggests that the two simultaneous changes are almost offsetting. A reduction in the corporate income tax rate is predicted, by economic theory [23], to lead to an increase in product market prices thus increasing taxable corporate income. This in turn should lead to a relative decrease in input prices and ultimately to increased production. The most important benefits to the industry is that it will increase the industry's efficiency and competitiveness by reducing the current preferential treatment of capital. This will ultimately lead to more efficient allocation of all factors of production, generating greater derived demand for labour and timber. It is hypothesized that this will lead to a more equitable treatment of forest management investments and potentially lead to greater investments. Baker's (1989) model of tax reform effects on the Canadian sawmill and planning mill industries predicts that this will in fact occur. Unfortunately, while the impact of tax reform on the competitive position of the forest industry has been assessed, no assessment of the impact on forest management investment has been completed. Baker (1990) does, however,suggest that the current corporate tax regime may not encourage forest management investment in Canada.

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[22] From 38 to 28 percent with the provincial corporate tax rebate of 10 percent still in place.

[23] According to Baker (1989) economists argue that theory suggests that the corporate income tax leads to increasing producer prices for output and decreased input prices. Ultimately, a decrease in the rate will "effectively increase the most price responsive outputs and factors of production." (Baker, 1989, p. 8)

In terms of cash-flow taxes, both the Australian and Saskatchewan governments have adopted a modified cash flow tax known as a Resource Rent Tax (RRT); Australia in the oil and gas industry (Kemp, 1987) and Saskatchewan in the uranium industry (Anderson ,1987). There is no known application of cash flow tax schemes used in the case of forestry. Schwindt (1987), however,suggests that the stumpage pricing appraisal system that existed in B.C. prior to 1987 had characteristics of a cash flow or resource rent tax.[24]

While lump-sum taxes are considered least distortional, they have rarely been used in the case of public forest resource taxation in Canada. The only exceptions are in the form of property taxes applied by municipalities on private land holdings (Boulter, 1984) and lease fees or levies on forest licences for the right to access timber (Pearse, 1990). Both of these forms of rent collection are typically very modest and insignificant to resource-based tax revenues. The absence of these taxes applied in Canada's resource industries may be related to the high costs of administration (Boulter, 1984) and to the fact that these levies lend themselves more to private resource holdings; holdings that are insignificant against a majority of publicly owned forest land.

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[24] The complementarity between stumpage pricing and other forms of taxation in appropriating economic rents is an important issue that will be discussed in greater detail in this paper.

CHAPTER III

INSTITUTIONAL CONTEXT OF ALBERTA'S FORESTRY SECTOR

A. Introduction

This chapter begins with a brief overview of the Alberta forestry sector, the nature of the forest resource, and the structure of the Alberta forest industry. Forestry tenure structures and their historical development will be examined, along with an examination of the costs of forest management, and an overview of the forest industry development currently occurring in Alberta. The chapter concludes with an assessment of historical rent collection by the Alberta, Federal and Municipal governments from the Alberta forest industry through several direct and indirect tax regimes, including stumpage prices, other forestry charges, and corporate income taxes.

B. Alberta Forest Resource Characteristics

Alberta's forest resources are one of the most important and valuable assets of the province. Alberta is 646,389 square kilometers [25]in size of which 349,673 sq.km. is forested land or better known as Green Area[26], or roughly 54 percent of the total land base. Of the total Green Area 94.5 percent is allocated to provincial forest management (27.9 percent under Forest Management Agreements and the remaining 72.1 percent under other tenure arrangements), 2 percent is Federal government controlled, less than 1 percent privately owned forest land, and the remaining 3.2 percent under Provincial parks, wilderness areas, natural areas, ecological reserves and Metis settlements. [27]

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[25] All statistics (with noted exceptions) are as per Timber Management Statistics, Alberta Forest Service, Alberta Forestry, Lands and Wildlife, April 30, 1990.

[26] Alberta lands are divided into the Green Area and the White Area. Green Area is forested lands withdrawn from settlement, managed for forestry and other multiple uses. White Area is the settled area of the Province. White Area lands do contain some forested lands that generally fall outside of the forest management units established in the Green Area, nevertheless, timber from White Area lands is often available for timber harvesting.

[27] Note that Forestry Canada (1990) Forestry Facts reports that based on Statistics Canada data, in 1986 96 per cent of forest land was publicly owned (89 per cent provincial government and 7 percent Federal

Forest land in both the Green Area and White Area of the Province are broken down according to productivity as follows,19.5 million hectares (or 54 percent) is productive forest land, 2.0 million hectares (or 5.6 percent) is potentially productive, and 14.3 million hectares (or 40.4 percent in non-productive forest land. Of the productive forest land 8.8 million hectares (or 45 percent) is pure coniferous (lodgepole pine and white spruce), 6.9 million hectares (or 35 percent) is pure deciduous (primarily aspen), and 3.8 million hectares (or 19 percent) is mixedwood conifer/deciduous forest land.

Alberta ranks fourth after Ontario, Quebec and then British Columbia in annual allowable cut (AAC) of timber available for harvesting per annum. Alberta has a coniferous AAC of 14.3 million cubic meters and a deciduous AAC of 10.4 million cubic meters for a total AAC of 24.7 million cubic meters of timber (Alberta Forest Service, 1990). The total growing stock of of all species is 2.2 billion cubic meters. Of the total growing stock volume, conifer species account for roughly 68 percent of the growing stock; 31.7 percent is white spruce, 27.3 percent is lodgepole pine, and 9.0 percent is other conifers (black spruce and balsam fir). Deciduous species, most importantly trembling aspen (*Populus tremuloides*), accounts for 32 percent of the total timber growing stock.

The amount of AAC allocated to the forestry industry has changed dramatically in the past ten years. In 1980, the percentage of AAC allocated to industry was 57.7 percent of coniferous and 0.05 percent of deciduous available AAC (Ondro and Williamson, 1982). By 1990 this had changed dramatically with 95.8 percent of the coniferous AAC and 81.4 percent of deciduous AAC committed under tenure or under tenures pending approval. In total, currently 89.7 percent of the total AAC for all species has been designated for commercial timber harvesting . Of the total AAC, 68.1 percent is currently committed under tenure and 21.7 percent is is pending final approval for allocation under various tenures. Of the remaining 10.3 percent of uncommitted AAC, 8.3 percent is designated under a Timber Development Area (TDA) slated for future forestry

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government) and 4 percent was privately owned by some 7,500 woodlot owners.

development.

The allocation of total AAC by tenure is as follows, 53.1 percent is under committed and pending Forest Management Agreement (FMA) tenure areas, 29.9 percent is under committed and pending Quota tenures, and the remaining 17 percent under miscellaneous timber tenures. The amount of forest land under FMA has increased dramatically since the early 1980's when only two FMAs existed. FMAs have increasingly become the preferred forest management unit of the Provincial government where large industrial forestry facilities are involved that require secure wood supplies.

It is worth noting the value of deciduous timber supplies and the prospects for tremendous forestry industrial expansion in Alberta that has come from the recent technological innovations into utilization of deciduous species, namely poplar logs (aspen). Alberta has roughly 725 million cubic meters of growing stock of poplars according to Ondro and Bella (1989). This is greater than all other North American jurisdictions except for Ontario, which has 1,011 million cubic meters. The two authors indicate that the poplar logs harvested have increased from 2.4 percent of the total timber harvested in 1980 to 15.4 percent in 1987. Recent innovations such as Oriented strandboard (OSB) technology (introduced from Germany into North America in the early 1980's), the new aspen chemi-thermomechanical pulp mill technology, and new innovations in using poplar logs in the bleached kraft pulping process have taken advantage of Alberta's substantial deciduous timber asset. All of these innovations have caused an explosion in demand for poplar logs and markets for associated products.

C. Alberta's Forest Industry

In September 1987 the Alberta government entered into the most ambitious development of the forest industry ever witnessed in the province. The Globe and Mail (1989) called it the "third-biggest forestry boom in Canadian history." The goal was to diversify the Alberta economy in very short order moving to an economy less reliant on the oil and gas industry.

This growth has been unprecedented.[28] In 1987, there were two pulp mills, with a productive capacity of 510,000 ADMT (air dry metric tonnes) of softwood bleached kraft pulp (SBKP) and with a value of $410 million. In addition, there were two building paperboard plants with a combined productive capacity of 60,000 tonnes per annum and one insulation board producer with annual capacity of 67,200 thousand square feet (1/2 inch basis). In 1993 there will be six (potentially seven) pulp mills (4 BKP producing both softwood bleached kraft pulp (SBKP) and hardwood bleached kraft pulp (HBKP) mills plus, 2 chemi-thermomechanical (CTMP) mills producing both softwood and hardwood mechanical pulp), and one newsprint mill in production. By 1998 to 2000 there is the possibility of an additional two CTMP mills, one BKP mill, and two fine paper mills. Therefore by the year 2000 potentially 2.9 to 3.1 million ADMT of pulp, newsprint and paper will be produced, consuming an estimated 14.6 million cubic meters of timber per annum, a six-fold increase over 1987.

There were roughly 203 sawmills in 1987 (Bamsey 1988) producing roughly 1.57 billion fbm of dimension lumber and boards. Roughly 87 per cent of this production was generated by only 19 sawmills with productive capacities in excess of 10 million board feet per annum. It is expected that by 1993 0.465 billion fbm of capacity will have been added amounting to a productive capacity of 2.0 billion fbm and consuming an estimated 8.8 million cubic meters of wood per annum. In 1988 there were 9 panel product facilities including 3 plywood plants producing 223 MM sq.ft. of plywood, 3 Oriented strandboard (OSB) plants producing 662 MM sq.ft. of OSB, one Medium Density Fibreboard (MDF) facility producing 50 MM sq.ft. of fibreboard, and 2 insulation board plants producing 65 MM sq.ft. of insulation board. This amounted to 945 MM sq.ft. of panel board production valued at roughly $200 million in 1987. By 1993 it is expected that an additional 100 MM sq.ft. of productive capacity will be added, almost exclusively OSB production. This level of production would require roughly 1.71 million cubic meters of wood input.[29] Total expansion of Alberta's forest industry since 1987 is expected to amount to capital expenditures in excess of $4.5 billion into the late 1990's.

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[28] The primary source for these figures is Bamsey (1988) *Directory of primary wood-using industries in Alberta - 1988* and the Forest Industry Development Division of Alberta Forestry, Lands and Wildlife. Wood input requirements are estimated based on average conversion returns on the production of respective forest products as per Alberta Forestry, Lands and Wildlife.

Alberta's forest products can be stratified into the following primary product categories: lumber (spruce-pine-fir or SPF), pulp (SBKP (Softwood Bleached Kraft Pulp) , HBKP (Hardwood Bleached Kraft Pulp) and CTMP (Chemi-ThermoMechanical Pulp)), and panelboard (plywood, OSB, medium density fibreboard (MDF)) products.[30] Alberta produces primarily S.P.F. or spruce-pine-firm dimension lumber. Until 1987 it produced only softwood bleached kraft pulp from coniferous timber stock (primarily logdepole pine). Since 1987, technological innovations has made utilization of poplar species possible in bleached kraft pulp production and in CTMP production. While the production of CTM pulp is expected to grow, based on projections for development CTMP production will account for only 25 percent of total pulp and paper produced by the year 2000. Of the panelboard products, OSB is increasingly the most important product being produced. The demand for OSB will likely continue to be strong primarily in the North American housing market. Plywood production and demand has stabilized or is declining mainly due to a decreasing supply of quality peeler sawlogs and increasing competition in the housing market from OSB and other panel products. While MDF is also an important panelboard product it sees a more limited market in the production of furniture.

D. Value of Forest Product Production

The value of forest product production in Alberta has also increased rather significantly. In 1978-79 Ondro and Williamson (1982) report value of shipments that were exported from Alberta to equal $181.6 million for pulp, paper and allied industries, $126.3 million for sawmill and planing industries, $22.7 million for panelboard industries, and $7.7 million for other forest product industries. This amounts to $338.3 million in value of shipments that were consumed outside of Alberta. An additional $91.6 million was consumed in Alberta. The total value of shipments of forest products in 1978-79 was therefore $429.9 million. In 1990 Statistics Canada estimates show the value of shipments had increased to $1,964 million, $983 million in wood industries (lumber, plywood,panelboard, etc.) and $643 million from pulp and paper industries. The increase in value of production is expected to continue reaching more than $3.0 billion by the year 2000 (Brennan, 1988) and this figure is probably conservative.

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[29] It should be noted that these production figures do not include other forest product production such as paper board, wood pallet, and fence post products that are relatively minor contributors to economic output.
[30] The author acknowledges that other primary wood products are produced including building paperboard, insulation board, construction paper, posts and poles, firewood, and railway ties. These are excluded from the rent calculations because they are minor contributors to value-added forest product production in Alberta.

E. Employment

An estimated 10,000 persons were directly and 16,000 indirectly employed by Alberta's forest industry in 1987 (Alberta Bureau of Statistics, 1988). In 1978-79 Ondro and Williamson (1982) reported employment of 6,417 person years in Alberta' forest industry with 56 percent employed in sawmills, 28.9 percent in pulp and paper mills and the remaining 15.1 percent in panelboard and other facilities. Employment is expected to increase dramatically as the new forestry developments are completed with an additional 4,000 persons expected to be directly employed and an additional 7,800 indirectly employed in Alberta's forest industry by 1995-2000.

F. Value-Added of Total Forest Industry Activity and Contribution to GDP.

The value-added generated by forest industry activity provides an indication of the relative contribution of the industry to the economy. Value-added is defined as:

> "the difference between the total revenue of a firm and the cost of bought-in raw materials, services and components. It thus measures the value which the firm has 'added' to those bought-in material and services by it's processes of production."
>
> (Source: Bannock,G. R.E. Baxter, and R. Rees, 1978, *The Penguin dictionary of economics.* Second edition, Penguin Books, Harmondsworth, England.)

Ondro and Williamson (1982) estimate the value-added from the Alberta forest industry as $487 million of which 43 percent is attributed to the primary wood-using industries (sawmill, pulp mills,panel board mills, etc.) and 57 percent to secondary and tertiary wood-using industries (eg. furniture manufacturers). The most important of the primary wood-using industries is the pulp, paper and allied industries which produced $100.6 million in value-added, followed by the sawmill industries contributing $89.7 million. In 1985, the total value-added from manufacturing and labour in these industries amounted to $264 million sawmills, $203 million in pulp and paper and 32 million in logging industries (Forestry Canada, 1990).

Alberta's forest industries (including logging, wood industries (lumber and panelboard) and pulp and allied industries) contributed $807.3 million to Alberta's gross domestic product (GDP) at factor cost or roughly 1.2 per cent of total provincial GDP (Alberta Bureau of Statistics, 1990). In 1978-79 Ondro and Williamson (1982) show that primary wood-using and secondary wood-using industries accounted for 8.6 percent and 11.4 per cent, respectively, of Alberta's manufacturing GDP, ranked sixth and third respectively. In 1989, the wood industries and pulp and allied industries accounted for 11.1 per cent of manufacturing GDP at factor cost.[31]

G. Exports of Forest Products

Alberta exports almost all of it's forestry production. In 1978-79 Ondro and Williamson (1982) show that 79 percent of forest products were exported out of the province. In 1989, total value of shipments of wood industries and pulp shipments were $1,516 million in 1989. $706.8 million or roughly 47 per cent was exported of which 92 percent went to the U.S. market. Roughly 53 per cent of the total value of forest product shipments went to domestic consumers including other provinces.[32] While some production has been exported to other provinces, the majority has gone to the U.S. market. In 1987 it is estimated that of the total exports outside of Canada originating in Alberta, 98 percent of the lumber went to the U.S., 97 percent of the pulp went to the U.S., and 99.8 percent of panelboard products went to the U.S. (Alberta Economic Development, 1990) This situation is expected to change with a "significant shift" expected to offshore markets such as Japan, S. Korea, and the European Community (Brennan, 1988). Increasing lumber and panelboard trade with Japan are examples of this shift occurring. Nevertheless, the U.S. will continue to be Alberta's most important market in which it is considered a price taker.

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[31] Note that comparisons between 1978-79 and 1989 are not entirely possible because 1989 figures for "wood industries", as reported by Statistics Canada , include some secondary-wood using industries along with primary wood industries.

[32] This could be somewhat overestimated because what Statistics Canada reports as domestic consumption may in fact include shipments that enter export markets (primarily U.S.) through other provinces of lading.

H. Forestry Tenures and Stumpage Policy Development In Alberta

This section of the paper provides a description of Alberta's forest tenures, and timber pricing and other forestry charge policies.[33] This provides some insight into the rational behind the historical treatment of forest rents by the Alberta government.

The primary objective of forest management in Alberta as endorsed by the Alberta legislature has historically been stated as follows:

> To manage Alberta's forest lands in a manner ensuring a perpetual supply of benefits and products while maintaining a forest environment of high quality (McDougall, 1986).

This objective is certainly broad enough to raise several questions about how it is interpreted in forest management and specifically timber pricing policies.[34] It would appear that at least initially, the Government of Alberta has spent less energy on the identification and collection of economic rents generated by the forest industry and more on economic development. This could be for several reasons. The collection of economic rent from the forest industry can be administratively complex and costly. Governments tend to favour rent collection mechanisms that both minimize administrative costs and yet ensure a stable flow of revenues to the provincial treasury (Gunton and Richards, 1987). This objective must be balanced with the need to ensure a stable and viable forest industry that can exist under these government policies and regulations. Maintaining stable production and employment in forestry communities in the province is as important, perhaps politically more important, than revenue generation. Furthermore, the Provincial forestry agency is responsible to ensure that timber supplies are sustained over time in accordance with a sustained yield policy for timber management. In obliging the forest industry to achieve these goals the government must ensure that resource management and pricing policies are sufficiently stringent yet fair so as to be conducive to allow firms to practice good forest management. Therefore, maximizing rent collections from the industry is only one, of many, objectives the government considers as part of resource management and pricing policies.

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[33] Much of the material regarding rights of tenure holders used in this section comes from Moen, Andrea (1990). *Demystifying forestry law: an Alberta analysis.*

[34] For an excellent discussion of forest management in Alberta the reader is referred to Environment Council of Alberta (1990). *Our dynamic forests: the challenge of management.*

H.1 Forest Management Agreements

Forest Management Agreements (FMAs) have increasingly become one of the most favoured forms of forest land tenure arrangements in Canada, a concept first introduced in Alberta in 1954. Currently, FMAs account for roughly 53 per cent of the allocated annual allowable cut. The first 20-year, renewable, area-based tenure arrangement was signed by the Northwest Pulp and Power Company (NWPPC) (now Weldwood of Canada) and the Alberta government in September of 1954. [35] This tenure structure was designed to meet the forest management needs of the province, that is, to provide a means of sustaining the timber resource, as well as meeting the needs of the firm, that is, a secure timber supply for its' pulp mill operations in Hinton.

The FMA, a negotiated agreement, is unique because it is the only Alberta forest tenure arrangement that requires firms to grow, harvest and establish timber on a sustained yield[36] basis where the firm assumes full responsibility for forest management, planning, and reforestation.[37]

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[35] Murphy, P (1990). National Management of the Forest - the Pursuit of Nature's Way. Excerpts from an interview with Reginald Loomis, former ADM, Alberta Forest Service, p 90-91.

[36] Sustained yield refers specifically to the sustaining of timber supply over time such, that is, "the yield that a forest can produce continuously at a given intensity of management" (Society of American Foresters).

[37] Note, an FMA agreement only provides the firm the right to harvest timber and in turn is obliged to manage future timber supplies, through reforestation and stand management, and provide access (that is, access roads construction and maintenance) to the timber at it's own expense. The FMA holder has no rights or obligations with respect to other non-timber forest land resources including wildlife.

The Minister of Forestry, Lands and Wildlife reserves all other land rights on the forest management area not expressly given the FMA holder including rights over management of fish and wildlife, and other non-timber resources(Moen 1990).

Initially, Northwest's FMA gave only timber cutting rights, however, in 1958 the terms of the agreement were broadened to include the right "to manage, cut, and remove the timber from the pulpwood lease area..." on a sustained yield management basis.[38] In 1961, the wording of the agreement was revised as follows: "The Minister gives to the company the right to enter upon and use the land to grow and harvest timber in accordance with the terms of the agreement." [39] This also resulted in the establishment of the annual allowable cut calculations for timber harvesting. Setting annual allowable cut levels involves fixing the volume of timber to be harvested every year using formulas that take into account the age distribution, volume, and historic rate of growth of the original stand (Pearse, 1990). Ultimately, the primary intent of these agreements is to provide long term security of timber supply to the firm in return for industry upholding certain responsibilities including reforestation and the development of commercial forestry facility, as described in each FMA.

Forest Management Agreements have evolved into rather comprehensive tenure arrangements and a means by which the government attracts forest industry investments. FMA holders are obligated to develop a major timber processing facility and manage timber on a sustained yield basis (AAC are determined by the Crown) in return for the right to harvest timber from a given forest land base. FMA holders are also responsible for soil and water management and must manage timber in recognition of other non-timber forest land values and uses including fish and wildlife habitat, and forest recreation. The firm is required to post a predetermined performance guarantee as insurance against default. FMA holders are fully responsible for the costs of forest management on the agreement area. Forest management responsibilities include, reforestation, reclamation, and logging road construction and maintenance. While not obligated to manage other non-timber resources many firms including Weldwood in conjunction with the Alberta Forestry, Lands and Wildlife are increasingly involved in wildlife habitat management as part of the management of the whole forest ecosystem. Other forest management activities such as intensive stand tending are optional but are encouraged through the annual allowable cut effect that provides the firm right to future access to additional timber supplies or AAC that have resulted from increased productivity from intensive forest management.

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[38] McDougall, F.W. (1986). Forest Management in Alberta p.17

[39] ibid

These agreements also evolved to encompass broader socioeconomic objectives. The most recently signed Daishowa Canada Co. Ltd. FMA is an example of how these agreements are intended to maximize the returns from the forest resource in terms of timber values and employment generation. The Daishowa FMA explicitly states the "desire" of the Minister of Forestry, Lands, and Wildlife to have the firm:

> - provide for the fullest possible economic utilization of forest stands and stable employment in local communities, and to ensure a perpetual supply of benefits and products while maintaining a forest environment of high quality by maximizing the value of the timber resource base and ensuring that it yields an uninterrupted flow of timber over time. " (Daishowa Canada Co. , Forest Management Agreement, August 3, 1989)

Because each agreement is a contract, the terms of the agreement will differ in accordance with the operating conditions.

While FMA holders are entitled to renewal of their agreement after the 20 year term has expired, renewal is not guaranteed. The ultimate decision for renewal is left to the discretion of the Lieutenant Governor in Council and so long as the company is not in default of the terms and conditions of the original agreement then the agreement is usually renewed.

H.1.1 Stumpage Pricing and Other Charges under FMAs

Each FMA holder pays stumpage fees and other forestry charges that are negotiated individually with the Alberta Government and are embodied in the legal agreement. Stumpage fees are negotiated in accordance with the specific characteristics of the forestry facility and the forest resource. In some cases, depending on the type of wood-using facility attached to an FMA and the wood requirements, stumpage rates may be subject to Timber Management Regulations. For example, in the case of pulpwood stumpage rates, these tend to be negotiated where there is a pulp and paper facility, however, sawlog stumpage rates for logs used in lumber production may be subject to regulated or administratively set stumpage prices.

Strictly speaking once the base or negotiated stumpage price is established in the FMA it will not change except for annual adjustments in accordance with a price ratio index tied to the pulp or other forest product price indices. These negotiated base stumpage rates are based in part on historical precedents set in other FMAs or on the current indexed stumpage rate charged to existing FMA holders.[40]

Stumpage prices or fees, whether negotiated or set through regulation, are not based on an appraisal of economic rents or conversion returns expected from the production of forest products by each tenure holder. Negotiated stumpage rates are based on a fair market price assessment completed by the Alberta Forest Service.[41]

Current stumpage pricing policy discriminates between the size and quality of logs harvested. For example, negotiated pulpwood stumpage rates are typically higher than sawlog stumpage rates. In 1989, average pulpwood stumpage charges were roughly $2.00 per cubic meter compared with the average sawlog stumpage rate of $0.70 per cubic meter, that is, almost 3 times more. Lower sawlog stumpage rates and higher pulpwood rates, in combination with strict utilization standards reflects government objectives of encouraging maximum utilization of sawlogs in lumber production and to encourage the use of wood chips and shavings (byproducts of lumber production) in the production of pulp and paper. It is important to note that while pulpwood stumpage prices are adjusted annually in accordance with product price indices there is no similar price adjustment to sawlog stumpage prices. This would tend to suggest that pulp producers would be encouraged to minimize harvest of pulpwood, maximize lumber production from sawlogs to the minimum utilization standard required (if the pulp mill has a sawmill facility), and purchase wood chips and shavings from other sawmills.

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[40] As per personal communication with Mr. Ron Dunnigan, Alberta Forest Service, March 20 1990, Edmonton.

[41] ibid. There is no detail documentation available on how this completed.

In addition to stumpage fees, FMA holders pay an annual assignment charge of $0.25 per cubic meter of allocated AAC, holding and protection charge of roughly $0.15 per cubic meter of AAC (levied on an area-of-FMA basis), and issuance fee of $0.07 per cubic meter of AAC. There are no reforestation charges because firms are responsible for all reforestation costs.

H.2 Timber Quotas and Other Tenures

The timber quota[42] has evolved as the second most important forest land tenure structure in Alberta after FMAs. As noted earlier, quotas currently account for roughly 30 percent of the allocated AAC. The holder of a quota has the right to a percentage of volume or AAC of a forest management unit but actual cutting rights are only issued through issuance of a licence. Thus, the Alberta Forest Service retains control of the cut to ensure that sustained yield is achieved (this differs from the FMA where the agreement holder is responsible). The quota system was introduced in 1966 in response to the need to establish a forest tenure system similar to FMAs except better suited to smaller woodland operators, such as lumber mills. They were intended to provide for a more orderly approach to forest industry involvement by smaller producers, like sawmills who may otherwise be constrained by economies of scale to maximize the full extent of forest resources. This tenure structure also provided a means of practicing sustained yield management on a broader spectrum of forested land.[43] Like FMAs, timber quotas are 20-year renewable agreements, however unlike FMAs , quotas are only volume agreements, giving the quota holder a right to the timber but not rights in the land on which the forest grows.

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[42] The term 'quota' is applied by the Alberta Forest Service referring specifically to coniferous timber. In the case of deciduous quotas, these are referred to as "deciduous timber allocations" or DTAs (see Moen 1990).

[43] Murphy, P (1990). National Management of the Forest - the Pursuit of Nature's Way. Excerpts from an interview with Reginald Loomis, former ADM, Alberta Forest Service, p 106-107.

Quota holders are responsible for the costs of reforestation or they may opt to pay a reforestation fee and have the work completed by the government. Quota holders are also responsible for road development and reclamation, and soil and water conservation. The Alberta Forest Service completes all forest inventory and forest management planning but, the quota holder completes his own operating plan for government approval. As with FMAs the annual allowable cut effect also applies.

In 1986, the majority of quotas issued in 1966 expired and were thus subject to renewal. Several changes to the terms and conditions of the quota system to improve forest management practices were also introduced concurrently. The most significant changes introduced included more stringent utilization standards moving to a minimum stump diameter of 15 centimeters.[44] In addition, reductions in rotation ages from 100 to 120 years, for coniferous tree species, to 80 years resulted in an overall increase in the annual allowable cut. There were however no changes to stumpage pricing even though they are set under regulation by the government.

Timber is also allocated through the issuance of commercial timber permits, local timber permits, forest product tags, and Christmas tree permits. These are all short term permits for a prescribed, usually small volume of timber, and for a defined time period. These permits are generally used in the case of surplus annual allowable cut which the Alberta Forest Service wants sold, or for the cutting of firewood, or Christmas trees. These forms of timber allocation are minor relative to quotas and FMAs and will not be dealt with in detail.

H.2.1 Stumpage Pricing and Other Charges under Quota and Other Miscellaneous Tenures.

Timber quotas are sold through a bonus-bidding, sealed bid, auction. Therefore, there is a one time, lump sum, ex ante payment for the quota. Quotas issued in 1966 and that were renewed in 1986 for another 20 years are exempt from this policy unless title is ceded by the firm or renewal is denied by the Minister. Therefore, it is conceivable that only new quotas will be sold through an auction, with the majority of older quotas renewed without a tendering process. This is done in part to ensure equitable treatment of quota holders and reward good timber management over the first tenure period. Bonus bids are apparently an important source of forest rent collection. For example, in the 1988/89 fiscal year quota sale revenues were estimated to be roughly $1.7 million or $0.33 per cubic meter of total harvest by all quota holders (that is, coniferous timber licences) (Alberta Forest Service,1990). Bonus bid revenues presumably vary considerably having exhibited revenues as low as $22,000 in 1984/85 and to as high as almost $3.0 million in 1986-87 (the year when most 1966 quotas were being renewed or reallocated).

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[44] Alberta Forestry, Lands and Wildlife (1984). *Timber Quota Policy*.ENR Report No. 1/51.p 5.

In addition to the bonus bid, quota holders pay annual stumpage fees that are set according to the General Rate of Crown dues in the *Timber Management Regulation* of Alberta's *Forests Act*. An adjustment factor is applied which takes into account factors associated with delivered wood costs (example, haul distances). Other factors considered include gross volume per hectare, gross volume per tree, and decay. The average or standard regulation stumpage fee on softwood or coniferous is $0.70 per cubic meter , a base rate established in 1975. Actual stumpage fees can vary considerably from between 25 per cent and 175 per cent of the regulation rate. Therefore stumpage rates on coniferous timber can vary from $0.18 per cubic meter to $1.23 per cubic meter.

Quota holders also pay a reforestation fee of $2.30 if they opt not to perform reforestation themselves. They also pay holding and protection charges of $0.15 per cubic meter of AAC (DTA holders pay $1.25 per hectare for deciduous allocation). The holding charge is in essence a ground rental charge for the privilege of holding the rights to harvest timber. The forest protection charge is meant to contribute funds to the Alberta Forest Service for fire fighting and for pest control. Assignment fees of $0.25 per cubic meter of AAC and issuance fees of $0.07 per cubic meter of AAC are also charged. The quota holder must also deposit a performance guarantee to a maximum of $75,000 to encourage the holder to comply with the provisions of the *Forests Act* and regulations and the terms of the timber disposition (Moen 1990).

What is unique about timber quotas is that economic rent is captured both *ex ante*, through bonus bids, and *ex post*, through stumpage fees and other charges.

Other types of forest tenures include Local Timber Permits (LTP), Forest Product Permits (FPP) or Tree Tags. Like quotas, they are allocated via an auction but bidding is in terms of per-unit of volume of wood allocated basis. Like timber quotas and permits, stumpage rates are paid in addition to the bid amount in accordance with the Crown Rate of Dues in accordance with *Timber Management Regulations*.

H.3 Evolution of Administratively Set Crown Rate of Dues or Stumpage Pricing

The historical development of the Crown Rate of Dues is important in understanding the current rationale behind why and how the Alberta Government prices timber resources. These Crown Rate of Dues are relevant for all tenures that harvest coniferous and deciduous sawlogs.[45] Prior to 1961, Alberta's basic coniferous stumpage rates on sawlogs were determined on the basis of a percentage (10 percent) of the average price of lumber sold. Rates were then adjusted annually according to lumber price indices changes. The Alberta Forest Products Association (AFPA) and the Alberta Forest Service (AFS), in 1961, agreed to apply a formula for stumpage pricing that would be more sensitive to market trends. This formula was based on a semi-annual mill survey where the average lumber selling price, weighted by volume, was taken. It was hoped that this revision would make stumpage rates more sensitive to market fluctuations.

In 1969 lumber prices fell sharply and upon the request of the Alberta forest industry, the government introduced another revision to the stumpage system that would see dues set on a monthly basis. This system consisted of two components: a) a schedule which extracted dues equal to 10 percent of the average lumber selling price and these adjusted according to monthly changes in lumber prices; and b) a lumber price index which could be used to produce monthly dues schedules. The average lumber selling price was derived using production costs plus a lumber conversion return value. The conversion return was based on government estimates of a "fair" profit margin, interest on working capital, and depreciation associated with lumber production. Although the new policy appeared to be neutral or non-distortional, it was criticized for being insensitive to down turns in the lumber markets [46]. The conversion return value used in the policy was also criticized for providing little investment incentives since it was felt to be based on an inappropriate allowance for returns to capital and depreciation.

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[45] The following is based on personal communication with Paul Precht, Alberta Energy, July, 1988 and Ron Dunnigan, Alberta Forest Service, over the course of two years 1988-1990.

With an impasse between government and industry on how to structure a more equitable stumpage policy, the government, in 1975, again endeavored to find a reasonable solution. A modified version of the Alberta Coal Royalty Formula was assessed for its potential application to the collection of economic rent from the forest industry. This formula was viewed as providing perhaps the most equitable and efficient rent collection option. However, it too was rejected because of several deficiencies, including it's complexity and administrative costs.

It was thus finally decided to establish a stumpage policy where prices would be administratively set through regulation. The result was that, in 1975, a base stumpage rate on coniferous sawlogs of $3.00 per thousand fbm or $0.70 per cubic meter was established. This rate was established in consideration of choosing a rate which would be both fair to all producers and yet provide reasonable and consistent revenue flows to the Alberta Government. This base rate could then be adjusted in accordance with the operating conditions faced by each tenure holder.

This discussion has focused only on coniferous sawlog stumpage rates. Historically deciduous trees had been seen by industry and government as economically unimportant. A base stumpage rate for deciduous timber was also established in 1975 at $0.25 per cubic meter, a rate still applicable to the majority of deciduous sawlogs. As noted earlier, pulpwood stumpage rates generally apply to FMA holders with a pulp mill facility and are negotiated rates between the firm and Government.

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[46] Such a downturn did occur in 1975 when the current base rate for coniferous and deciduous sawlogs was set at $0.70 and $0.25 per cubic meter respectively.

Since this dynamic period in stumpage policy evolution in Alberta, there has been virtually no change in the pricing policy. In a review of provincial forest tenures, Samson (1987) indicates that for the 1985/86 period, the weighted average stumpage rate for all coniferous timber harvested was $0.72 per cubic meter[47] and $0.33 per cubic meter for deciduous tree species. In 1988/89 the average stumpage rate for all coniferous timber (including sawlogs and pulpwood) was $0.95 per cubic meter and for deciduous timber, $0.29 per cubic meter[48]. Coniferous pulpwood rates in 1988/89 averaged an estimated $1.98 per cubic meter and deciduous pulpwood rates averaged $0.36 per cubic meter. Coniferous sawlog stumpage rates averaged $0.87 per cubic meter and deciduous sawlogs averaged $0.26 per cubic meter. A weighted average of all stumpage collected in 1988/89 suggests an estimated $0.86 per cubic meter collected on the total timber harvested. This mean rate reflects that fact that stumpage rates vary markedly between tenures by the type of logs harvested, be they pulpwood or sawlog, and by species. In the past five to six years, pulpwood stumpage rates have ranged from $1.20 to $2.00 per cubic meter in any given year while sawlog stumpage rates have ranged from $0.65 to $0.90 per cubic meter. This variability reflects several factors including changing market conditions and changing operating conditions.

I. Estimates of Direct and Indirect Taxation of the Alberta Forest Industry

This section summarizes the estimates of direct taxes (corporate income tax (federal and provincial) and municipal tax) and indirect taxes (stumpage fees, and other forestry charges) collected by government's from the Alberta forest industry during the years 1979 to 1990. These estimations are shown in table 3.1. Indirect taxes are, in a sense, a proxy for forestry rents collected by the Alberta government. Direct taxes are taxes on income or profits, which are net of

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[47] Note, the weighted average for coniferous stumpage rates includes sawlog and pulpwood stumpage rates.

[48] All figures are as per Timber Revenue Section, Alberta Forest Service and personal communication with Ron Dunnigan, Timber Revenue Section, Alberta Forest Service, March 20, 1990.

Table 3.1

DIRECT AND INDIRECT TAXES PAID BY THE ALBERTA FOREST INDUSTRY

(thousands of constant 1986 dollars)

Year	Indirect Taxes		Total of Indirect Taxes	Direct Taxes			Total of Direct Taxes	TOTAL OF ALL TAXES
	Stumpage & Other Forestry Charges	Lumber Export Tax		Corporate Income Tax		Muncipal Taxes		
				Federal	Provincial			
1979	11,665	0	11,665	n/a	n/a	n/a	n/a	n/a
1980	10,551	0	10,551	22,947	12,437	7,534	42,918	53,468
1981	11,072	0	11,072	15,330	8,452	6,885	30,667	41,739
1982	12,038	0	12,038	9,626	5,125	6,416	21,167	33,205
1983	16,677	0	16,677	5,450	2,952	6,186	14,588	31,265
1984	18,931	0	18,931	7,017	5,483	6,071	18,571	37,502
1985	17,809	0	17,809	6,149	4,527	5,988	16,664	34,473
1986	18,555	0	18,555	9,049	7,589	6,000	22,638	41,193
1987	20,523	16,460	36,983	16,156	11,614	5,725	33,495	70,478
1988	18,610	16,475	35,085	28,635	19,090	5,914	53,640	88,724
1989	15,665	13,185	28,850	18,180	12,119	5,642	35,941	64,791
1990	13,699	10,368	24,066	7,794	5,765	5,887	19,447	43,513
Averages	15,483	14,122	20,190	13,303	8,650	6,205	28,158	49,123

Source: Alberta Public Accounts; Statistics Canada Cat.No. 61-207, 61-208; Notes: n/a – not available.

(1) Derivation of corporate income taxes are based on Howard's (1979) approach (see table 3.2).

(2) Municipal tax data is not publicly available and is estimated. 1979 data is estimated based on the figure reported by Ondro and Williamson (1979) in their study of Alberta's forest industry. Other data is estimated and projected based on expansion in the industry based in part on growth in value of shipments. Typically municipal taxes are based on individual municipality appraisals of land values which will vary.

1986 and 1987 data were estimated by Forest Industry Development Division and published in an Edmonton Journal article.

(3) Indirect taxes includ stumpage and other forestry charges as reported in the Alberta Public Accounts for the Department of Forestry, Lands and Wildlife. Fiscal period, current dollar figures are converted to calendar year, constant 1986 dollar basis (using the GDP Implicit Price Index for Canada). Other forestry charges include reforestation fees, timber damage assessment fees, bonus bid revenues, and holding and protection charges.

indirect taxes already incurred. While direct taxes, such as corporate income taxes, do in essence appropriate rents, it is not their intended purpose.[49]

This analysis excludes some taxes such as property taxes on private forest land are insignificant to Alberta (Baker, 1990) because of the small private forest land base and are thus not considered. Personal income taxes from forest industry employees are excluded from the analysis because they are not directly linked to the rents that arise from the manufacturing and processing of timber resources. Other forestry charges and collections include bonus bids on the sale of quotas and timber licences, holding and protection charges, reforestation fees , assignment fees, cruising and mapping charges, timber damage assessment charges, and permit fees.

I.1 Corporate Income Tax

Corporate income taxes are an important source of government tax revenues collected from the forest industry by both the Alberta and Federal government. Because actual corporate income taxes paid to both federal and provincial governments by provincial forestry industries are not reported or available from Statistics Canada, it is necessary to impute these values. We use Howard's (1978) innovative approach used for British Columbia and subsequently adopted by White (1983), also for the BC forest industry.

The federal corporate tax paid by the Alberta forest industry can be estimated based on the following methodology. Given that Statistics Canada report on the corporate taxes paid by the total Canadian forestry industry by sector (wood industries, pulp, paper and allied, and logging) , it is possible to estimate that portion paid by the Alberta industry. This is accomplished by taking the ratio of taxable income from the Alberta industry sector divided by the taxable income from the entire Canadian forest industry sector then multiplying this ratio against the federal corporate income taxes paid by the Canadian forest industry. That is,

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[49] The primary data sources is the Alberta Public Accounts and Statistics Canada.

$$\frac{\text{Taxable income Alberta forest industry}}{\text{Taxable income Canadian forest industry}} \times \begin{array}{l}\text{Federal corporate income taxes paid by}\\ \text{the Canadian forest industry}\end{array}$$

This is possible because the federal corporate income tax rate is uniform across Canada. The results are shown in the table 3.2 .

The same method can be used to estimate the provincial corporate income tax paid by the Alberta forest industry. However, as Howard (1978) notes, the results may be biased because the provincial corporate tax rates differ across provinces and therefore applying the same ratio against the aggregated provincial corporate income tax paid by all provincial forestry sectors may be inaccurate. An alternative approach is to use the Public Accounts of the Province of Alberta to arrive at more a more accurate estimate of provincial corporate income tax. This involves transforming the fiscal year, provincial corporate income tax data for all forest industries to a calendar year basis. This figure would then be multiplied against the ratio of Alberta forest industry taxable income to the total taxable income of all Alberta industries. This method has some minor flaws because of the conversion to a calendar year basis from a fiscal year. However,Howard (1978) notes that the differences in results are negligible and fall out as you aggregate over several years.

I.2 Municipal Tax

Municipal taxes levied on the forest industry in smaller Alberta communities are also an important source of revenue for local governments. Unfortunately, there is no publicly available data of municipal taxes paid by forestry-related industrial activity. The only study which estimated municipal taxes is the 1978-79 study by Ondro and Williamson (1982) in which they report local municipal taxes of $5.45 million in 1978-79. More recent estimates by the Forest Industry Development division and published in an Edmonton Journal article suggest municipal tax revenues of $6.0 million in 1987/88 from the Alberta forest industry. Municipal taxes for the years 1980-90 shown in table 3.1 are estimated. In general, municipal taxes are estimated based on an

Table 3.2

Estimates of Corporate Income Tax Paid by the Alberta Forest Industry: 1979–1990.

($ thousands, current)

		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Federal	Logging	580	x	x	x	x	496	618	x	x	x	x
	Wood Industries	3,246	2,812	2,028	1,327	1,208	1,485	2,398	4,333	3,618	2,935	1,206
	Pulp and Paper	12,925	9,590	6,433	3,703	5,472	4,523	6,651	12,599	27,852	18,008	8,061
	TOTAL	16,751	12,402	8,461	5,030	6,680	6,008	9,049	16,932	31,470	20,943	9,267
Provincial	Logging	320	x	x	x	x	333	414	x	x	x	x
	Wood Industries	1,879	1,570	888	589	679	980	1,587	2,733	2,412	1,956	804
	Pulp and Paper	6,880	5,268	3,617	2,136	4,541	3,443	6,002	9,438	18,568	12,005	6,051
	TOTAL	9,079	6,838	4,505	2,725	5,220	4,423	7,589	12,171	20,980	13,961	6,855
Total	Logging	900	x	x	x	x	829	1,032	x	x	x	x
	Wood Industries	5,125	4,382	2,916	1,916	1,887	2,465	3,985	7,066	6,030	4,891	2,010
	Pulp and Paper	19,805	14,858	10,050	5,839	10,013	7,966	12,653	22,037	46,420	30,013	14,112
	TOTAL	25,830	19,240	12,966	7,755	11,900	11,260	17,670	29,103	52,450	34,904	16,122

Sources: Statistics Canada Cat.No. 61–208, Alberta Public Accounts.

Statistics Canada Cat. No. 61–207 (Table VII–1 Selected Forestry Statistics (Forestry Canada)

Estimation Approach based on W.G. Howard, 1978. Estimates of Taxes, Fees and Royalties Paid by the B.C. Forest Industry and Employees: 1971–1975, Environment Canada, Forestry Service, Victoria, B.C.

Notes: x – confidential to meet secrecy requirements under Statistics Act

(1) 1990 figures are estimated based on three quarters reported. 1990 was a poor year for forest products with third quarter figures showing a $12 million loss for wood industries because of slumping lumber prices.

appraisal of land values in each respective municipal district.

I.3 Lumber Export Tax

An export tax of 15 per cent on the value or price of lumber exports to the U.S. is currently being levied by the Government of Canada with subsequent reimbursement to provincial governments. In October 1986 the International Trade Administration of the U.S. Department of Commerce made a preliminary ruling in favour of a U.S. Coalition for Fair Lumber Imports supporting the Coalition's claim that Canadian softwood lumber was subsidized through grants and artificially low stumpage rates to the extent of 15 per cent of the value of lumber. The U.S. subsequently imposed a 15 per cent countervailing duty on all Canadian lumber imports which was in turn replaced with the existing Memorandum of Understanding which imposed a 15 per cent export tax on the value of Canadian softwood lumber shipments to the U.S. The tax has been in place since January 8, 1987.

Some provinces were exempt (including, New Brunswick, Nova Scotia) because an unfair advantage was not seen by the U.S. government, however most of the major producing provinces including British Columbia, Ontario, Quebec and Alberta were affected. B.C. has subsequently eliminated the tax opting for offsetting increases in provincial stumpage rates affecting the entire forest industry. Quebec has chosen a partial offset alternative. Alberta and Ontario continue to reject the M.O.U. and the tax and pursue it's elimination. They have not replaced it, neither in whole or in part. Recent efforts by the Federal government to open up talks with U.S. to renegotiate or eliminate the M.O.U. have, to date, been unsuccessful. The tax is collected by the Federal government which then reimburses the Alberta government, where these tax revenues enter general revenues. A summary of lumber export tax collections since 1987 are shown in table 3.1.

I.4 Stumpage and Other Forestry Charges

Stumpage charges and other forestry charges are lumped together in the Alberta Public

Accounts and are thus not separated for purposes of our analysis. These combined collections are shown in table 3.3. Other forestry charges include holding and protection charges, reforestation levies, bonus bids from quota sales, timber damage assessment charges, cruising and mapping, assignment fees, and permit fees.

Holding and protection charges are collected as a form of payment to partially offset the costs to government of protecting the forest resource from fire and insect damage. These charges vary according to the type of timber disposition and specific characteristics of the tenure and are levied on an area basis for each respective Forest Management Agreement holder. Timber quota holders and timber licence holders are charged on a fixed rate basis per unit of annual allowable cut. Rates for FMA holders range from $7.08 to $27.22 per square kilometer (Alberta Forest Service, 1989). These charges are adjusted annually according to changes in the Consumer Price Index or the Annual Implicit Price Index for Government Expenditures. Timber quota holders and timber permit holders are charged on a fixed rate basis of roughly $0.15 per cubic meter of annual allowable cut (Samson , 1987).

Other fees and charges include cruising and mapping, assignment fees, permit fees, and timber damage assessment charges. The first three aforementioned fees amounted to roughly $0.05 per cubic meter in 1988 (Alberta Forest Service, 1989). Timber damage assessment charges are collected from oil and gas companies and other industrial users of forest land that remove or disturb timber and other forest surface resources. These charges can amount to a rather significant portion of forest tax revenues. For example, in the 1988/89 fiscal year these fees amounted to roughly $0.82 per cubic meter of the total harvest or $6.6 million.

The majority of tenure holders in Alberta are obligated to incur the full cost of reforestation. If a quota holder harvests in excess of 34,000 cubic meters of timber per annum the operator is required to complete the reforestation work at his or her own expense. This includes all Forest Management Agreement holders and the majority of quota holders. Where a tenure holder harvests less than 34,000 cubic meters of timber per annum, the holder has the option to pay for the reforestation themselves or pay a levy of $2.30 per cubic meter of wood harvested to the government. This levy is based on the estimated average cost of reforestation incurred by the Alberta Forest Service. Reforestation standards are set out under the Timber Management Regulations and are strictly enforced.

In February 1991, a new "free-to-grow" reforestation policy was introduced by the Minister of Forestry, Lands and Wildlife resulting in more stringent reforestation standards and imposing additional forest management costs on firms. The free-to-grow standard was introduced as an extension and improvement of the existing reforestation requirements to ensure that seedlings planted or otherwise established on a cut-over site would meet a given height and vigor requirement (free of grasses and other competition within 15 years of site harvest). It has been estimated (Alberta Forest Service) that these new reforestation guidelines could add an additional $2.00 to $4.00 per cubic meter of wood harvest to the current estimated $2.30 per cubic meter reforestation cost .

In addition to covering reforestation costs, tenure holders are also responsible for the construction and maintenance of logging roads and most other road infrastructure. The Alberta Forest Service estimates that road construction and maintenance costs amount to roughly $2.00 per cubic meter of wood harvested for the average operator. The government is responsible for forest protection activities, that is fire suppression, and other activities such as the inventory of timber and other forest resources.

CHAPTER IV

EMPIRICAL RESULTS - ESTIMATION OF FORESTRY RENTS IN ALBERTA

A. Introduction

This fourth chapter contains an empirical valuation of Alberta forestry rents and assesses the success of governments in the collection of these rents through various tax regimes. The chapter contains an empirical estimation of forestry rents generated by the Alberta forest industry using two analytical approaches for the years 1979 to 1990. The first method, referred to as the 'residual valuation approach" is the most direct approach to imputing economic rents using observed, actual or estimated (forecast) variable and fixed production costs, and forest product prices to determine residual values or rents generated by primary forest product manufacturing. Rents will be imputed by forest product with respect to production activities of lumber, pulp and paper, and plywood and other panelboard industries.

The second method, referred to as the "value added approach", adopts methodology similar to that used by Copithorne (1979) and Percy (1986) in their imputation of forestry rents in Canada and in British Columbia respectively. Economic rents are imputed by taking the difference between the value-added for forestry production activity for each forestry sector (logging, sawmill, plywood and panel board, and pulp and paper industries) less salaries and wages, and the opportunity cost of capital. The value added approach affords us the ability to observe forestry rents in both primary and secondary forest product manufacturing. The rents imputed using both methods can then be compared with one another and will provide a range of forestry rent values.

The estimation of economic rents generated by resource industries, in this case forestry, is difficult and complex primarily because of the absence of reported, observed or actual data on both the price and cost side of the equation. Earlier work by Copithorne (1979) assessed the value of forestry rents and the success of stumpage pricing mechanisms used in all Canadian provinces. Copithorne's work found evidence of considerable windfall gains in the form of uncollected rents accruing to the B.C. forest industry. Percy's 1986 study of British Columbia for the Economic Council of Canada applied Copithorne's approach but directly estimated the value of forestry rents in British Columbia comparing these values to actual stumpage and other provincial forestry charges. Percy found that 58.8 per cent of forestry rents from the total B.C. forest industry and 32.2 per cent from the logging industry specifically were not captured by the provincial government through stumpage and other indirect forestry charges. However, Percy noted that because the rents he imputed contained some quasi-rents suggests that the province may in fact have been quite successful in capturing rents despite the inherent limitations of current stumpage pricing regime. Both these studies provide important insights into empirical methodology that can be applied in imputing forestry rents for Alberta. No publicly available study of economic rents in Alberta's forest industry has to our knowledge been completed.

The two methods applied will be referred to as the "residual valuation approach" and the "value added approach" for lack of more appropriate terminology. The residual valuation approach derives rents in a cash-flow, accounting framework using reported prices and industry surveyed production cost data from various sources. The value added approach uses macroeconomic methodology using Statistics Canada to impute rents. Both methods use a similar method of imputing the opportunity cost of capital or the quasi-rent on capital. In both cases, a residual value or economic rent is imputed by deducting, from the value of shipments or production, the variable and fixed costs of production as well as an estimate of the opportunity cost of capital as a proxy for the required return on forestry capital investments. This economic rent or residual includes "any economic profits that arise from market power as well as Ricardian rents accruing to the resource base employed in the industry " (Percy, 1987,p.39). Thus, it will also contain monopoly rents, if they exist.

We would expect that both methods will provide similar results even though different data components and starting points for analysis are used. There is no *a prior* information that suggests that the residual valuation results are more robust or accurate than the value added results. Two methods are used to , in a since, check the accuracy of our rent imputations and to improve our confidence in the findings.

In this exercise we attempt to target specifically the primary wood-using industries, which include sawmills and planing mills, pulp mills, paper and newsprint mills, and panelboard product mills, such as producers of plywood, oriented strandboard, waferboard, and medium density fibreboard. This is not to discount the importance of secondary wood-using industry who also generate economic rent from the production of value-added forest products. The value added approach results do provide some insights into the extent of rents both in the primary and the combined primary and secondary wood-using industries.

The study period covers the years 1979 to 1990, a period which is representative of the cyclical nature of Canadian forest product markets. It also includes the U.S. and Canadian recession periods of 1979-80 and 1981-82. Another reason for choosing this time period is because it provides a resumption point from the Ondro and Williamson (1982) study of the Alberta forestry in 1978-79.[50] Thus, our confidence in the results is heightened, knowing that the study period is sufficient and representative of the nature of the forestry sector.

B. Opportunity Cost of Forestry Capital or Quasi-rents on Capital

Because the opportunity cost of capital calculation is common to both methods and is a critical component of the rent imputation it will be dealt with first. We define the opportunity cost of capital as "the interest forgone by the investors holding the net capital stock plus its depreciation (plus an inflationary adjustment for appreciation) " (Copithorne, 1979, p.191). In other words, it is the rate of return on invested capital that an investor requires in order to continue with the forestry investment rather than investing in the next best manufacturing industry investment opportunity. This imputation also has built in the relative risk associated with a forestry investment relative to both a riskers investment, for example, a government bond, and relative to other investments in the market place, for example, investments in stocks in companies trading on the Toronto Stock Exchange (TSE).

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[50] The Ondro and Williamson (1982) provides one of the most comprehensive studies of the socio-economic structure of Alberta's forestry sector in the year 1978-79.

By measuring the opportunity cost of capital we are in essence measuring the quasi-rent on forestry capital invested, that is the rent that capital captures as a result of forestry production. In order for firms to continue to invest in the industry in the long-run, it must receive a rate of return on the forestry investment equal to the opportunity cost of capital rate of return.

The opportunity cost of capital or value of capital services[51] may be imputed using the following formula:

opportunity cost of capital = interest forgone + depreciation

or

$$C_t = r_t(K_t + I_t + V_t) + D_t \qquad (1)$$

where C_t is the opportunity cost of capital in year *t*, r_t is the opportunity cost of capital interest rate, K_t is the year-end net capital stock of buildings, structures, machinery and equipment; I_t is an inflationary adjustment to account for the appreciated value of capital stock from one year to the next; V_t is the inventory held in year t; and D_t is the depreciation value of net capital stock

Data on net capital stock of buildings, structures, machinery and equipment (C_t) and depreciation value (D_t) are taken directly from Statistics Canada, Capital Stocks and Flows Section. In this case a special report for Alberta wood industries and pulp and allied industries was used.

A geometric depreciation rate was assumed to impute both year-end net capital stock and depreciation value (D_t). A geometric depreciation rate is one which has been developed by Statistics Canada in studies of the observed (as opposed to reported in accordance with accounting guidelines) depreciation rates typical of capital investments in Canada. In their research, they surveyed and observed actual depreciation of capital investments and compared these actual figures against what would have been predicted if conventional accounting depreciation methods, including straight-line depreciation, were used. The results of the studies showed that the actual depreciation behavior was closest to a geometric depreciation rate, that is, a pattern of depreciation in which the productive efficiency of capital declines over time at an accelerated rate. Further studies by Komanakos and Hwang (1989) found that manufacturing industries exhibit this geometric depreciation rate. In our study, we apply Statistics Canada reported depreciation values and net capital stock values based on this geometric depreciation technique for Alberta.

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[51] Note in the tables showing imputation we refer to the opportunity cost of capital and the value of capital services.

An inflationary adjustment (I_t) is used to account for the appreciation in value of capital and is included in the "interest forgone" portion of our equation. The imputation of this inflationary adjustment is consistent with the study by Percy (1986) in which it is assumed that the increases in the price of new capital goods could lead to some increase in the nominal value of capital stock still in use. This inflationary adjustment can be imputed by deriving a capital good index as follows:

$$\text{capital goods index} = \frac{\text{current value of capital stock}}{\text{constant value estimate of capital stock}} \qquad (2)$$

Both current and constant values for net capital stock are available from Statistics Canada. The capital goods index is then further adjusted downwards by a factor of 50 per cent to account for possible productivity differences between old and new capital stock. The final index is then applied against the current year net capital stock to estimate the inflationary value of capital.

Inventory values (V_t) are defined by Statistics Canada as representing the book value of owned inventory held in Canada, including goods in transit to the respondent held by others on consignment of manufacturing and non-manufacturing activity. Unfortunately, since inventories for Alberta's forest industry were not reported by Statistics Canada (because of confidentiality of information) they had to be imputed from aggregate Canadian forest industry inventory figures.

The only exception is pulp and paper inventories for 1979 to 1982 which were actually reported by Statistics Canada. The inventories for the Alberta forest industry are calculated based on the assumption that the ratio of Alberta value of shipments to the total Canadian value of shipments in forest products provides a proxy for the ratio of Alberta forest industry inventories to the Canadian total.

The opportunity cost of capital interest rate (r_f) is perhaps the most important variable for imputing the total value of capital services. This interest rate is a measure of the risk associated with an investment in capital and represents the rate of return required by an investor that is sufficient to provide incentives to continue with that investment rather than reallocating capital elsewhere. Copithorne (1979) assumed that r_f was equal to the average rate of return or yield on industrial bonds (as reported in the Bank of Canada Review). Percy (1986) made the same assumption but added an arbitrary two per cent premium to account for risk associated with forestry investments. In our approach we advocate a more sophisticated approach to imputing this r_f value borrowing from the finance literature.

B.1 Opportunity Cost of Capital Interest Rate

To determine r_f we go to the Capital Asset Pricing Model (CAPM) (Sharp,, 1964; Lintner 1965) to measure the risk and the performance of forestry investments *ex post*. In our analysis we will consider the performance of the entire Canadian forest industry on the basis of returns on equity on investment. The CAPM theory specifies an equilibrium relationship between an asset or project "*j*"*'s* expected rate of return (R_j), the risk free rate of return (i) and the expected risk premium on the market portfolio of all assets in the economy (R_m). Thus we have the equation (3):

$$R_j = i + (R_m - i)\beta_j \qquad (3)$$

where $\beta_j = \mathrm{cov}(i, R_m)/\mathrm{var}(R_m)$ which is known as the CAPM beta coefficient for asset or project *j*.

This beta is a measure of the systematic risk or non-diversifiable risk associated with the asset *j* (Washburn and Binkley, 1990).

This ßj can be imputed by taking *ex post* or historical rates of return on an asset or security and regressing these values on contemporaneous risk premium for the market portfolio (Jensen, 1969). Thus we have the equation:

$$R_{j,t} - i_t = \beta_0 + \beta_j (R_{m,t} - i_t) + U_{j,t} \tag{4}$$

where $U_{j,t}$ is the random disturbance error term of project *j* in time *t*. The risk-free rate of return (i_t) at time *t* is based on the Canadian government long term (10-year) bond rates used as a proxy for a risk free asset. β_0 is the slope intercept or coefficient (referred to in the finance literature as the CAPM alpha), which measures the difference between the rate of return that an asset has actually generated with the rate that was justified by its level of systematic risk. The market rate of return ($R_{m,t}$) is based on the average annual rate of return on the TSE300 (Toronto Stock Exchange, 300 primary trading stocks) in time *t* (see table 2.0 (appendix)). This is consistent with the finance literature and theory (Van Horne, 1989 and Washburn and Binkley, 1990).

In the case of $R_{j,t}$, the project's or asset's rate of return, we use the rate of return on equity in the entire Canadian forest industry as a proxy for the return on capital. Return on equity imputations for the forest industry is possible from corporate financial statistics available from Statistics Canada. While individual forestry sector estimates are available we use an aggregate for the entire forest industry in Canada. This imputation of returns of forest industry equity is shown in table 3.0 (appendix). In this case, equity is common equity (with preferred share equity and preferred share dividends netted out). This provides us with an *ex post* rate of return on forestry investments in the Canada. Data for 1988 and 1989 were not available from Statistics Canada and thus were supplemented with similar data calculated by Price Waterhouse (1990) for these respective years. 1990 data was not available from any source.

The use of a return on equity measure,in conjunction with a stock price rate of return (the

TSE300 rate of return) and a government bond rate, may appear unconventional when traditional applications of the CAPM theory have been used in determining stock price betas for securities traded on the stock market. These CAPM betas for stock prices are used to measure the systematic risk of an individual security or stock in relation to the market. We consider our application appropriate in light of other similar approaches by Washburn and Binkley (1990) where they use the CAPM approach to measure the relative risk associated with U.S. forestry investments using stumpage prices as the $R_{j,t}$ variable. In the Washburn and Binkley study, stumpage prices are in essence the rent value of forestry investments similar to the residual values we are imputing. In the Washburn and Binkly study, the rate of return on U.S. Treasury bills is used as a proxy for i, and the Standard and Poor 500 index for the New York stock exchange as the proxy for R_m.

From equation (4) we can then estimate the β_j or CAPM beta coefficient through simple regression techniques (using OLS), regressing the excess market rate of return (R_m - i) on the excess forestry asset rate of return (R_j - i). The value of the beta coefficient is important because the larger the value of beta, the greater the assets systematic risk and the greater the expected rate of return on an investment. The lower the beta value, the lower the risk, the more valuable the investment becomes, and the lower the expected rate of return. A beta of one, for example, implies that an investment is at least as risky as the market and thus is expected to earn the same rate of return. A beta of zero implies an investment that will earn only the risk-free rate of return, that is, the bond rate. Finally, a negative beta implies an investment is expected to earn less than the risk-free rate of return.

Regression results provide a CAPM beta of 0.299 and a CAPM alpha (β_0) of 0.044. The results were not statistically significant at the 90 per cent confidence interval. These findings are important because suggesting two things: first, that the risk associated with forestry equity investments is apparently less than the risk associated with investing in all other stocks on the TSE300 (while forestry investments may be valuable they apparently have lower risk associated with them in comparison with risky investments in the TSE300 and this implies having lower expected rates of returns associated with them.), and; second, the results may imply that forestry stocks on the TSE300 are overvalued. This is hypothesized because evidence of weighted average stock price betas for twenty Canadian forestry companies (imputed by Computer Portfolio Management Systems Inc. of Toronto on special request) shows a weighted average five year stock price beta of 1.29 (see table 4.0, appendix). The reason for the discrepancy between the stock price betas and our own beta based on returns on equity in forestry investments is beyond the scope of this study but is certainly worthy of further research. While the low beta coefficient values we imputed may appear unusual it is suggested that they may in fact be accurate given the study results of Washburn and Binkley (1990) who found CAPM beta coefficients ranging from -0.5120 to 1.2967 when using U.S. stumpage prices of various tree species as proxies for forestry asset values.

By fitting the βj back into equation (3) we can calculate an average expected rate of return (r_f) on forestry equity over the study period 1979 to 1990.[52] - This done by modifying equation (3) somewhat so that R_m becomes the average period market rate of return and "i" becomes the average risk-free rate of return (r_f) for the period thus yielding an average expected rate of return of 12.08 per cent, as shown in table 4.1. This r_f value is thus the expected rate of return on capital and forestry equity employed during the period 1979 through 1990.

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[52] An average rate of rate of return is used instead of calculated a year-specific rate because we assume capital investments made during the study period by firms would be based on financial/investment forecasts and analysis that would apply an expected rate of return over the life of the facility or capital assets.

Table 4.1

Opportunity Cost of Capital Interest Rate Calculation

Year	i Risk-free Rate 10 Year Government Bond (per cent)	Rm Market Rate of Return TSE300 Stocks (per cent)	Rj Expected Rate of Return on Forestry Equity (per cent)
1979	10.21	44.77	15.59
1980	12.48	30.13	17.35
1981	15.22	-10.25	14.31
1982	14.26	5.54	-3.87
1983	11.79	35.49	-2.80
1984	12.75	-2.39	7.13
1985	11.04	25.07	5.07
1986	9.52	8.95	11.89
1987	9.95	5.88	17.57
1988	10.22	11.08	20.30
1989	9.92	21.37	12.70
1990	10.91	-14.80	n/a
Average	11.52	13.40	10.48

Derivation of Beta

$Rj = i + (Rm - i)Bj$, where Bj or Beta = 0.299 (see appendix__ for calculation)

Average Opportunity Cost of Capital Interest Rate for Forestry Investments (1979-1990)

$Rj = i + (Rm - i)Bj$; $Rj = 0.1152 + (0.1340 - 0.1152)\ 0.299$; $Rj = 0.1208$ or 12.08 percent

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Sources: Bank of Canada Review (various issues), B14007, B14008 and B14048.

Statistics Canada (various issues)." Corporation Financial Statistics". Cat.No. 61-207. Notes: n/a – not available.

(1) i – is the risk-free rate of return based on 10 year government bond rates. A long term bond rate is used because forestry investments are generally long-term ventures in excess of 10 years.

(2) Rm – is the rate of return on stock prices of 300 major stocks of the Toronto Stock Exchange.

(3) Rj – is the estimated return on equity of Canadian forestry companies (see table 2 in appendix)

(4) Bj – Beta is the systematic risk on equity associated with forestry investments and is calculated using least square regression (see appendix

(5) Rj is the average required rate of return on forestry equity which is used as a proxy for the opportunity cost of capital interest rate. It is the rate of return on equity invested in forestry required for firms to continue with investments in forestry rather than investing in other manufacturing industries.

B.2 Opportunity Cost of Capital Estimates.

This r_f value can then be used in equation (1) to determine the opportunity cost of capital, referred to in tables 4.2 to 4.7 as the "total value of capital services." The final results of this imputation are presented in these tables where the Alberta forest industry is disaggregated into sawmills and planing mills, veneer and plywood mills, wood industries (an aggregate which include the first two categories plus other secondary wood using industries), pulp and paper mills, and paper and allied (an aggregate which includes pulp and paper and other secondary pulp or paper-using industries). This disaggregation has been made in an attempt to separate primary wood-using manufacturing industries from secondary. We do know that the total of wood industries and paper and allied represents the sum total of all Alberta forest industries.

These opportunity cost of capital figures are shown both in gross terms and in per unit of production terms to be used later, respectively in the residual valuation approach and the value added approach to rent imputation. As evidenced, the capital costs have increased substantially in 1989 and 1990 due to the substantial ongoing capital investment occurring in Alberta's forest industry. Capital investment in the pulp and paper industries is particularly dramatic. In this analysis we have used actual capital investment expenditures reported for the Alberta industry in several periodicals including Pulp and Paper Week and the Pulp and Paper Journal rather than the projected Statistics Canada figures, which are only projections. It should be cautioned that despite the increased accuracy of measuring actual capital expenditures, the opportunity costs of capital for these two years (1989 and 1990) will be overstated relative to other years and we would expect these costs to moderate somewhat to somewhere close to pre-1989 constant dollar levels. The overstatement of capital cost figures for these two years is a result of a lag effect whereby actual production lags the actual timing of capital expenditures . We would thus expect the opportunity costs of capital, particularly on a per unit of output basis, to return to pre-1989 levels once these new mills have achieved full production capacity.

Table 4.2

Estimated Opportunity Cost of Capital for Alberta's Forestry (Logging) Industries (1979-1990)

(millions of current dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Opportunity Cost of Capital Interest Rate (%)	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08
Net Capital Stock of Buildings Structures,Machinery,Equipment	33	38	44	45.0	42.0	40.0	38.0	36.0	35.0	33.0	33.0	34.0
Inflationary Adjustment to Capital	1.7	2.1	2.6	1.4	0.8	0.8	0.2	0.3	0.3	0	0.7	0.6
Inventory	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Geometric Depreciation Value of Structures and Buildings	2.2	2.7	2.9	3.0	3.1	3.0	2.8	2.8	2.9	3.3	4.0	4.3
Total Value of Capital Services	6.4	7.5	8.5	8.6	8.3	7.9	7.4	7.2	7.1	7.3	8.1	8.5

Sources: Statistics Canada, Unpublished Investment and Capital Stock data; Stats.Canada, Cat.No. 31-001;

Notes:n/a- not available;

Notes:(1)Opportunity cost of capital interest rate as per table 4.1.

(2) Depreciation value of structures, machinery and equipment is based on a

geometric depreciation rate advocated by Statistics Canada for use in manufacturing industries.

(3) Total value of capital services = (net capital stock + inflation adjustment + inventory) x opportunity cost of capital + depreciation

Table 4.3

Estimated Opportunity Cost of Capital for Alberta Sawmill Industries (1979-1990)

(millions of current dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Opportunity Cost of Capital Interest Rate (%)	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08
Net Capital Stock of Buildings,Structures,Machinery,Equipment	66.4	78.5	94.5	96.8	97.5	95.6	90.7	108.4	116.3	124.7	150.8	170.4
Inflationary Adjustment to Capital	3.3	4.4	5.7	3.1	1.9	1.8	0.5	0.9	1.1	0.01	3.3	3.1
Inventory	24.4	28.2	34.1	29.6	37.2	44.0	41.5	46.4	53.7	53.8	51.2	55.3
Geometric Depreciation Value of Buildings,Structures,Machinery,Equipment	16.4	19.6	24.3	26.1	27.1	26.9	25.8	29.3	31.4	33.7	40.7	46.0
Total Value of Capital Services	27.8	33.0	40.5	41.7	43.6	43.9	41.8	48.4	52.1	55.2	65.5	73.6
Estimated Total Lumber Production (MMfbm)	999.2	1057.1	1198.1	1088.5	1554.8	1481.5	1655.2	1813.5	2209.6	2348.8	2204.5	2176.7
Estimated Opportunity Cost of Capital per Unit of Total Production ($/Mfbm)	**27.79**	**31.24**	**33.82**	**38.35**	**28.04**	**29.65**	**25.27**	**26.66**	**23.56**	**23.52**	**29.72**	**33.82**

Sources: Statistics Canada, Unpublished Investment and Capital Stock data; Stats.Canada, Cat.No. 31-001; Bank of Canada Review; Price Waterhouse, Forest Products Industry Survey.

Notes:(1)Opportunity cost of capital interest rate as per table 4.1.

(2) Net capital stock from 1987 to 1990 are estimated based on capital expenditures expected from lumber capacity development and associated capital investments.

(2) Depreciation value of structures, machinery and equipment is based on a geometric depreciation rate applied by Statistics Canada in the case of manufacturing industries.

(3) Total value of capital services = (net capital stock + inflation adjustment + inventory) x opportunity cost of capital + depreciation

Table 4.4

Estimated Opportunity Cost of Capital for Alberta's Plywood and Veneer Industries (1979–1990)

(millions of current dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Opportunity Cost of Capital Interest Rate (%)	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08
Net Capital Stock of Buildings Structures,Machinery,Equipment	8.7	10.8	11.9	11.2	11.3	10.8	9.8	9.8	10.7	12.5	14.6	15.3
Inflationary Adjustment to Capital	0.4	0.6	0.7	0.4	0.2	0.2	0.1	0.1	0.1	0	0.3	0.3
Inventory	4.0	4.4	5.7	6.2	4.7	4.9	3.6	5.9	8.9	8.2	8.0	8.4
Geometric Depreciation Value of Buildings,Structures,Machinery,Equipment	2.2	2.7	2.9	3.0	3.1	3.0	2.8	2.8	2.9	3.3	4.0	4.3
Total Value of Capital Services	3.8	4.6	5.1	5.2	5.1	4.9	4.4	4.7	5.2	5.8	6.8	7.2
Estimated Plywood Production (M Msf 3/8" basis)	150	175	200	200	223	223	223.4	230	230	223	227	227
Estimated Opportunity Cost of Capital per Unit of Total Production ($/MSF 3/8")	25.22	26.34	25.55	25.75	22.68	22.07	19.79	20.39	22.83	25.88	29.94	31.71

Sources: Statistics Canada; Unpublished Investment and Capital Stock data; Stats.Canada, Cat.No. 31–001; Bank of Canada Review; Price Waterhouse, Forest Products Industry Survey.

Notes:(1)Opportunity cost of capital interest rate as per table 4.1.

(2) Depreciation value of structures, machinery and equipment is based on a geometric depreciation rate advocated by Statistics Canada for use in manufacturing industries.

(3) Total value of capital services = (net capital stock + inflation adjustment + inventory) x opportunity cost of capital + depreciation

(4) 1980 to 1983 plywood production figures are estimates.

Table 4.5

Estimated Opportunity Cost of Capital for Alberta's Wood Industries (1979–1990)

(millions of current dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Opportunity Cost of Capital Interest Rate (%)	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08
Net Capital Stock of Buildings,Structures,Machinery,Equipment	94.1	111.1	130.6	131.4	130.0	126.4	118.6	135.1	158.6	194.2	208.2	224.7
Inflationary Adjustment to Net Capital	3.3	4.4	5.7	3.1	1.9	1.8	0.5	0.9	1.1	0.01	3.3	3.1
Inventory	34	34	34	34	34.9	36.4	38	44.6	47.1	53.2	53.7	55.5
Geometric Depreciation Value of Buildings,Structures,Machinery,Equipment	23.3	27.7	33.6	35.5	36.1	35.5	33.7	38.0	42.5	50.4	57.5	63.1
Total Value of Capital Services	39.2	45.8	54.2	55.9	56.2	55.4	52.7	59.8	67.5	80.3	89.5	97.3

Sources: Statistics Canada, Unpublished Investment and Capital Stock data; Stats.Canada, Cat.No. 31–001; Bank of Canada Review; Price Waterhouse, Forest Products Industry Survey.

Notes:(1)Opportunity cost of capital interest rate as per table 4.1.

(2) Depreciation value of structures, machinery and equipment is based on a
geometric depreciation rate advocated by Statistics Canada for use in manufacturing industries.

(3) Total value of capital services = (net capital stock + inflation adjustment + inventory) x opportunity cost of capital + depreciation

Table 4.6

Estimated Opportunity Cost of Capital for Alberta's Pulp and Paper Mills (roughly 75 per cent of Paper and Allied)
(millions of current dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Opportunity Cost of Capital Interest Rate (%)	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08
Net Capital Stock of Buildings,Structures,Machinery,Equipment	115.6	129.5	151.4	169.8	164.4	163.4	173.9	185.5	193.2	201.2	298.5	1144.3
Inflationary Adjustment to Capital	4.7	5.5	4.7	2.2	2.0	2.9	3.2	6.2	1.7	0.1	6.6	11.8
Inventory	15.7	19.2	24.6	35.2	30.4	30.4	32.3	29.2	31.6	34.6	39.2	41.7
Geometric Depreciation Value of Buildings,Structures,Machinery,Equipment	18.3	20.6	24.0	26.9	26.0	27.2	27.5	29.8	30.9	32.2	51.0	131.9
Total Value of Capital Services	34.7	39.2	45.8	52.0	49.8	50.9	52.8	56.5	58.3	60.7	92.6	276.5
Total Pulp and Paper Production (,000 ADMT)	490.0	490.0	490.0	502.4	547.4	581.9	617.4	595.2	638.3	662.7	714.4	1092.9
Estimated Opportunity Cost of Capital per Unit of Total Production ($/ADMT)	70.88	79.96	93.52	103.40	90.97	87.50	85.54	94.99	91.26	91.56	129.60	253.03

Sources:Estimated based on table 6 and assuming capital service components to be 75 per cent of total paper and allied industries based on relative value of shipment figures for pulp & paper

Notes:(1)Opportunity cost of capital interest rate as per table 4.1.

(2)Depreciation value of structures, machinery and equipment is based on geometric depreciation rate adovacted by Statistics Canada as applicable to manufacturing industries.

(3)Total value of capital services = (net capital stock + inflation adjustment + inventory) x opportunity cost of capital + depreciation

(4)Net Capital Stock for 1988 to 1990 are based on reported or actual capital expenditures in Alberta's pulp and paper industry plus an inflationary adjustment based on average annual increase in net capital stock from 1979 to 1988. High value of capital services in 1990 reflects a lag effect between capital investment and production.

(5)Estimated opportunity cost of capital per unit of production 1989 and 1990 are based on productive capacity of new mills otherwise figures would be grossly overinflated.

Table 4.7

Estimated Opportunity Cost of Capital for Alberta's Paper and Allied Industry (includes Pulp and Paper Mills)

(millions of current dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Opportunity Cost of Capital Interest Rate (%)	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08
Net Capital Stock of Buildings,Structures,Machinery,Equipment	154.2	172.7	201.8	226.4	219.2	217.9	231.9	247.3	257.8	268.3	373.8	1228.8
Inflationary Adjustment to Capital	6.2	7.3	6.3	2.9	2.7	3.9	4.2	8.3	2.2	0.1	8.8	15.7
Inventory	41.8	49.8	66.5	87.1	74.5	85.8	81.4	74.8	50.5	59.6	49.6	68.9
Geometric Depreciation Value of Buildings,Structures,Machinery,Equipment	24.4	27.4	32.0	35.9	34.7	36.2	36.7	39.8	41.2	42.9	68.0	175.8
Total Value of Capital Services	48.8	55.2	65.2	74.1	70.5	73.4	75.1	79.7	78.7	82.5	120.2	334.5
Total Pulp and Paper Production (,000 ADMT)	490.0	490.0	490.0	502.4	547.4	581.9	617.4	595.2	638.3	662.7	714.4	1092.9
Estimated Opportunity Cost of Capital per Unit of Total Production ($/ADMT)	99.64	112.57	133.00	147.52	128.79	126.06	121.56	133.93	123.27	124.53	168.26	306.03

Sources: Statistics Canada, Unpublished Investment and Capital Stock data; Stats.Canada, Cat.No. 31–001; Bank of Canada Review; Price Waterhouse, Forest Products Industry Survey.

Notes:(1)Opportunity cost of capital interest rate as per table 4.1.

(2)Depreciation value of structures, machinery and equipment is based on geometric depreciation rate adovacted by Statistics Canada as applicable to manufacturing industries.

(3)Total value of capital services = (net capital stock + inflation adjustment + inventory) x opportunity cost of capital + depreciation

(4)Net Capital Stock for 1988 to 1990 are based on actual or reported capital expenditures in Alberta's pulp and paper industry plus an inflationary adjustment based on average annual increase in net capital stock from 1979 to 1988. High value of capital services in 1990 reflects a lag effect between capital investment and production.

(5)Estimated opportunity cost of capital per unit of production 1989 and 1990 are based on productive capacity of new mills otherwise figures would be grossly overinflated.

C. Residual Valuation Approach to Imputing Forestry Rents

The first method, the residual valuation approach, for imputing rents might be considered as the most direct approach to measure rents by simulating the transactions costs and market prices for forestry products of each subsector of the forestry industry during the study period. This approach is, in essence, a modified appraisal valuation approach or modified Rothery method similar to the method of stumpage valuation and thus stumpage charges in British Columbia, prior to 1987,[53] and for timber on U.S. Federal forest lands. The basic formula for deriving residual values, conversion returns or rents is to net out from the price of forest products sold, the variable costs of production and the opportunity cost of capital, that includes an allowance for risk. This assumes an average efficient producer. The net difference is the economic rent available for collection as stumpage. This is in a sense a cash flow approach to measuring economic rents based on reported prices and costs. One of the drawbacks of the B.C. and U.S. stumpage pricing structures is that in the imputation of opportunity cost of capital "the imputation of profit is not based on the actual capital stock employed by the average efficient operator. Instead, it is an allowance based on a (arbitrary) percentage of operating profits and stumpage values' (Percy, 1986). Percy also suggests that failure to correctly allow for profits to capital stock actually employed may have serious implications for the efficient use of capital. Our approach for allowing for returns to capital employed is believed to be a considerable improvement and superior to these other methods capturing the ex post expected rates of return on capital that includes not only returns to capital but to common equity of the firm.

Our analysis covers the major primary wood-using industries in Alberta including sawmills, plywood, oriented strandboard (OSB), medium density fibreboard (MDF), pulp mills (including softwood bleached kraft pulp (SBKP) producers , hardwood bleached kraft pulp (HBKP) producers, and chemi-thermomechanical pulp (CTMP) producers) ,and one newsprint mill. One of the advantages of this approach is the ability to observe economic rents specific to any given forest product. We have not attempted to value rents associated with secondary wood-using industries such as furniture, coffin, window and door frame, asphalt, preserved pole and post, construction board, and stationary paper producers, to name only a few.[54] These secondary wood-using industries undoubtedly contribute a great deal to the value-added of manufactured forest products.

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[53] On October 1, 1987, British Columbia introduced a new stumpage pricing policy using a 'comparative value pricing' structure to value timber and set stumpage charges. This approach differs from the former modified Rothery method in that stumpage charges are set in accordance with government revenue targets for any given year and in this sense stumpage pricing has become more administrative than market driven.

One peculiar aspect of the residual valuation approach is that the total variable costs of production already include indirect taxes, that is the costs of stumpage and other forestry charges imposed by the Alberta government. Therefore, the rents we impute may be viewed as windfall rents (similar to those imputed by Copithorne (1979)), that is rents that are captured by firms in excess of rents already collected through indirect taxation.

Production costs and product price data was available from several sources, the most important being Resource Information Services Inc. (R.I.S.I.) , a forest products forecasting and monitoring agency, from Bedford, Massachusetts. Other sources of data included Silvacom Ltd. of Edmonton and Statistics Canada. Every attempt was made to produce Alberta specific production cost data however, due to the concentration in industries, such as the pulp and paper industry, information is usually confidentiality and requires us to estimate values or determine proxies based for example, on British Columbia Interior pulp mill production costs or other jurisdictional cost structures. Some costs (as noted on respective tables) were adjusted to account for the operating conditions faced by Alberta forms vis-a-vis other Canadian jurisdictions. Despite the fact that these cost figures may not be precise, the results do provide some sense of rents in these industries. Only through detailed cost surveys or audits of the Alberta industry could we refute or confirm these results.

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[54] These secondary wood-using industries are however, captured in the value added approach to rent imputation.

C.1 Rents from Lumber Production

Table 4.8 shows the rents imputed for sawmills based on the sale of lumber (spruce-pine-fir) and residues, including chips and shavings to pulp and paper mills. Lumber prices are as reported by the Alberta Forest Products Association and are mill net, f.o.b. (free-on-board)[55] and residue income is as reported by RISI for Alberta mills surveyed. The variable costs of production, for an are average, efficient Alberta lumber producer, includes delivered wood costs (including stumpage and other forestry charges), labour, energy, supplies and administration and overhead costs (see also table 5.0 , appendix).

As already noted, the delivered wood costs include indirect taxes, including stumpage charges, lumber export charges, and other forestry charges incurred by the firm therefore, the residual value or economic rent imputed already nets out these indirect taxes. The lumber export tax payments are included in 1987 to 1990 figures explaining, in part, the increasing delivered wood costs.

The results show rents on a per thousand board feet of lumber produced basis, both before and after accounting for the opportunity cost of capital. The results are significant because the show that for rents, net of capital costs, have been negative for 6 years of the 1979 to 1990 study period. The large negative rents in 1989 and 1990 are likely indicative of the impact of the lumber export tax. The results seem to suggest while firms are earning rents before capital costs their operations generate negative or marginal returns, at best, when factoring in normal returns to capital investments. This would suggest that reinvestment in new or replacement capital stock is constrained. It also seems to suggests that lumber production generates at best marginal returns on investment in timber capital.

As an illustration of the sensitivity of rents to the variables which determine rents, we use simple regression (Ordinary Least Squares (OLS) regression) techniques to assess which variable best predicts the changes in rents and also determine the elasticity of each independent variable

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[55] Free-on-board is a term that denotes the actual mill price received by the producer free of transportation costs to markets which are assumed by lumber brokers who buy lumber from these producers and market it primarily in U.S. markets.

Table 4.8

ESTIMATES OF ECONOMIC RENTS IN ALBERTA'S SAWMILL INDUSTRY

($ per thousand foot board measures (fbm) lumber, in current $)

Year	Lumber Prices	Residue Income	Ave. Total Costs	Rents Before Capital Costs	Opp. Cost of Capital	Estimated Net Economic Rent
1979	216.44	26.50	162.84	80.10	27.79	52.31
1980	179.21	22.61	168.38	33.44	31.24	2.20
1981	179.00	22.59	173.91	27.68	33.82	-6.14
1982	161.74	34.00	214.00	-18.26	38.35	-56.61
1983	213.35	25.00	204.00	34.35	28.04	6.31
1984	193.80	27.00	209.00	11.80	29.65	-17.85
1985	196.40	21.00	207.00	10.40	25.27	-14.87
1986	214.01	20.00	203.00	31.01	26.66	4.35
1987	201.29	23.00	183.00	41.29	23.56	17.73
1988	201.50	26.00	200.00	27.50	23.52	3.98
1989	188.38	31.00	221.00	-1.62	29.72	-31.34
1990	185.85	30.00	230.00	-14.15	33.82	-47.97
Averages	194.25	25.73	198.01	21.96	29.29	-7.32

Sources:Custom FORISM report for Alberta, Resource Information Services Inc. (RISI);
The Alberta Forest Industry Report, Silvacom Ltd.; Statistics Canada, Cat. No. 25–201 and 25–202.

(1)The lumber prices and production costs represent thoes of an average Alberta mills producing chips and shavings as byproducts of lumber production
Lumber prices are Alberta Mill Net (f.o.b.) prices as reported by the Alberta Forest Products Assoc.

(2)Residue income includes revenues from sale of chips and shavings.
Residue income for 1983–1990 based on RISI figures for Alberta. Residue income 1975–1982 were estimated based on changes in lumber prices.

(3)Average variable cost breakdown are from RISI (see table 5.0 (appendix)). This includes delivered wood costs (including stumpage, reforestation, and reforestation costs), labour, energy, and supplies, plus general administration costs and road construction/maintenance proxy
Increases in costs for 1988–1990 cost data reflect the impact of the lumber export tax paid by Alberta producers.
Source for 1982–1990 is RISI; other cost figures are estimated based on Alberta Forest Service estimates for those years.

(4)Rents before capital costs are essentially rents to timber or wood inputs not already collected through forestry charges such as stumpage.

(5)Opportunity cost of capital is as per table 4.3 and is essentially the quasi–rent on timber attributed to capital.

(6)Estimated economic rents=price+residue income–ave.var.costs–opp.cost of capital with respect to lumber rents. Regressing the price of lumber plus residue income, average variable costs of production, capital costs on lumber rents, and a trend variable (to assess whether there is a pattern in the movement of rents) yields the following results:

$$\text{Lumber rents} = -68.709 + \underset{(0.4725)^{***}}{1.3114\ (\text{lumber price + residue income})} - \underset{(0.269)^{****}}{1.0903\ (\text{variable costs of production})}$$

$$- \underset{(1.5902)^{**}}{4.2518\ (\text{capital costs})} - \underset{(2.3538)}{3.3752\ (\text{trend variable})} \qquad (5)$$

where the figures in brackets are standard errors of each coefficient. The symbols **** signifies statistical significance at the 99 per cent confidence interval , *** signifies significance at the 98 per cent confidence interval, and ** signifies significance at the 95 per cent confidence interval. The determination of elasticities of each variable is estimated using a log-log transformation of the same equation. This yields the following results:

Variable	Elasticity
Lumber rents	-
Lumber price + residue income	10.9329
Average variable costs	-5.2726
Capital costs	-2.4763

The results show that, in terms of elasticities, and change in lumber rents is most sensitive to changes in lumber price and residue income, following closely by changes in average variable costs. The results show that forest rents are more sensitive to changes in average variable costs than the price of lumber and wood residues. There is also an apparent downward trend in lumber rents, although this is not statistically significant.

C.2 Rents from Pulp and Paper Production

Tables 4.9, 4.9, 4.11 show the results of rents imputed for the pulp and paper industries. Rents for softwood bleached kraft pulp (SBKP), hardwood bleached kraft pulp (HBKP), chemi-thermomechanical pulp (CTMP), and newsprint are determined. The majority of pulp and paper rents were generated by SBKP production until 1988 when expansion into HBKP, CTMP and newsprint began to occur. The prices for these products are based on market pulp and paper prices based on those reported by RISI for Northeastern U.S. markets where the majority of Alberta pulp products are sold. Total variable production costs are based on RISI reported data for British Columbia Interior mills with some minor adjustments. B.C. Interior mill costs are used in the absence of Alberta specific data. These costs include delivered wood costs (including stumpage and other forestry charges), energy, labour, chemicals, administrative overhead, and costs of transportation to Northeastern U.S. markets (see table 6.0 ,appendix, for a detail cost breakdown). Costs for 1979 to 1986 are adjusted to account for the added costs of reforestation and road construction and maintenance Alberta producers faced. This adjustment is $19.26 per air dry metric tonne (ADMT) of pulp produced based on Alberta Forest Service estimates of reforestation costs of $2.30 per cubic meter of wood harvest and road costs of $2.00 per cubic meter of wood harvest and assumes 30 per cent of wood input is purchased in the form of chips from other sources. Production costs for 1987 through to 1990 are assumed to be similar to B.C. Interior since producers were then faced with similar operating conditions being responsible for road and reforestation costs. Using B.C. Interior costs as a proxy for Alberta producers may in fact overestimate Alberta costs because, according to Rod Young, Pulp and Paper Analyst with RISI, Alberta producers typically have lower wood costs (lower stumpage and lower chip prices), lower labour costs, and lower energy costs.[56]

Table 4.9 show rents for softwood bleached kraft pulp (SBKP), the primary pulp product produced in Alberta . The results show significant rents in all years except 1982 and 1983 when pulp prices were significantly depressed. It is also noteworthy that rents in 1989 and 1990 are significant despite significant increases in capital costs during this expansionary period in the industry.

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[56] The Canadian Pulp and Paper Journal (November 1989 issue) supports this claim reporting that Alberta mills face the lowest delivered wood costs of any Canadian province as well as having low energy costs because of lower natural gas prices, lower electricity costs, good labour relations, and good mill locations along major river systems.

Table 4.10 shows rents for hardwood bleached kraft pulp (HBKP). Prices are from RISI and Pulp and Paper Week periodicals. We assume capital costs to be similar to SBKP costs and average total production costs to be similar excepting that stumpage charges for hardwood inputs are lower therefore a downward adjustment of $11.00 per ADMT is made. While minor volumes of HBKP were being produced prior to 1989 exact figures are unavailable thus we consider only 1989 and 1990 when HBKP capacity was increasing. HBKP production is expected to increase substantially in the 1990s to roughly 1,400,000 ADMT, almost double SBKP production and accounting for an estimated 50 per cent of total pulp production capacity by 1998 (see table 18.0, appendix).for future forest product capacity projections). Again, the rents are significant except for the unique anomaly of 1990 with greater than average capital costs resulting in negative rents. We would except future rents to be similar or greater than those of SBKP, *ceteris paribus*.

Table 4.11 shows rents for chemi-thermomechanical pulp (CTMP) for 1989 and 1990. Prices are as per Pulp and Paper Week reports for Canadian CTMP delivered to U.S. markets. Total variable costs are assumed to be 75 per cent of SBKP costs which according to Rod Young of RISI is appropriate. Unfortunately RISI will only begin reporting CTMP production costs in late 1991. Capital costs are also assumed to be 75 per cent of SBKP costs. The rents are even greater for CTMP. CTMP capacity is just beginning to be developed in Alberta and is expected to reach 580,000 ADMT or almost 21 per cent of total pulp production.

Rents from newsprint production were also estimated. Newsprint was being produced in Alberta in 1990 by Alberta Newsprint Company beginning in August 1990. The rent imputation is based on Canadian newsprint prices of Can. $649 per tonne, average total costs of Can $434 per tonne (B.C. West Coast and Eastern Canadian mill costs), and capital costs of Can $146 per tonne (Data is from RISI). This yields a newsprint rent of $69 per tonne of newsprint.

Table 4.9

ESTIMATES OF ECONOMIC RENTS IN ALBERTA'S PULP INDUSTRY

($ per air dry metric tonne (ADMT) of pulp, in current $s)

Year	SBKP Prices	Ave. Total Costs	Rents Before Capital Costs	Opp.Cost of Capital	Estimated Net Economic Rent
1979	500.60	362.26	138.34	70.88	67.46
1980	606.42	446.26	160.16	79.95	80.21
1981	635.42	504.26	131.16	83.52	47.64
1982	621.31	525.26	96.05	103.40	-7.35
1983	521.52	504.26	17.26	90.97	-73.71
1984	678.00	526.26	151.74	87.50	64.24
1985	627.00	509.26	117.74	85.54	32.20
1986	620.00	497.26	122.74	94.99	27.75
1987	767.00	500.00	267.00	91.26	175.74
1988	855.00	523.00	332.00	91.56	240.44
1989	962.00	556.00	406.00	129.60	276.40
1990	970.00	581.00	389.00	253.03	135.97
Averages	697.02	502.92	194.10	105.18	88.92

Sources: Pulp & Paper Review and RISI Yearbook, Resource Information Systems Inc.(RISI); Statistics Canada, Cat. No. 25-201 and 25-202; Pulp & Paper Week, Miller Freeman Pub.

Notes: (1) SBKP is Canadian Bleached Kraft Pulp and prices are proxies for Alberta based on Alberta's main export market (U.S. North East) prices for Alberta pulp reported by RISI.

(2)Canadian Softwood Bleached Kraft Pulp (SBKP) prices for Alberta pulp are based on Pulp and Paper Review, RISI. Exceptions are 1989 and 1990 which are per Pulp & Paper Week.

(3)Average total costs for production of Alberta Bleached Softwood Kraft Pulp are not available from any source becaues of confidentiality thus are based on RISI data for B.C.-Interior mills (see table 6.0 (appendix)).

Total variable costs include delivered wood costs (including stumpage, reforestation, etc.), labour, energy, and chemicals) plus rail transportation costs to North Eastern U.S. markets plus admin. overhead costs

A $19.26 adjustment is added to costs for 1979 to 1986 for road and reforestation costs incurred by all Alberta producers while B.C. producers were fully reimbursed. In personal communication with Rod Young, RISI,

March 21, 1991, using B.C.-Interior costs is appropriate with notable exceptions, including Alberta producers face lower wood costs (lower chip prices and stumpage fees), lower labour costs, and lower energy costs.

(4)Rents before capital costs are essentially the rents from timber or wood over and above stumpage and other forestry charges already included in the average total costs; (5) Opportunity cost of capital are

estimated as per table 4.8. 1990 figure is estimated to be $200.00 per ADMT because otherwise actual figure is over inflated.

(6)Estimated net economic rent = SBKP price - average total costs of production - opportunity cost of capital.

Table 4.10

CURRENT AND PROJECTED ECONOMIC RENTS FOR HBKP (Hardwood Bleached Kraft Pulp)

(Can$ per air dry metric tonne (ADMT) pulp, current $s)

Year	HBKP Prices	Ave. Total Costs	Rents Before Capital Costs	Opp. Cost of Capital	Projected Net Economic Rent
1989	855.00	545.00	310.00	129.60	180.40
1990	790.00	570.00	220.00	253.03	-33.03
1991	769.82	545.00	224.82	n.a.	n.a.
1992	806.42	559.00	247.42	n.a.	n.a.
1993	901.58	596.00	305.58	n.a.	n.a.
1994	877.25	623.00	254.25	n.a.	n.a.
1995	841.31	636.77	204.54	n.a.	n.a.
1996	879.43	650.54	228.89	n.a.	n.a.
1997	913.96	664.31	249.64	n.a.	n.a.
1998	949.44	678.09	271.36	n.a.	n.a.

Source: Pulp and Paper Week (various issues), Millar Freeman Publications; Pulp and Paper Review, December 1989. Resource Information Systems Inc.

Notes: E – estimated; n.a. – not available

(1)HBKP prices are for deliveries to U.S. markets by North Eastern U.S. mills and are projected by RISI to 1994. 1995–1998 are projected at 96 per cent of SBKP prices.

(2)Bleached Hardwood Kraft Pulp (HBKP) prices are projections made by RISI

Canadian Hardwood Kraft Pulp prices were reported as $855.00 in 1989 and $790.00 in 1990.

as per Pulp and Paper Week, Millar Freeman Publications, San Francisco, USA.

(3)Average total costs of production for HBKP are assumed to be similar to those for softwood bleached kraft pulp except that stumpage fees for hardwood wood input is roughly one fifth of softwood (coniferous) furnish. Thus total average costs for HBKP are adjusted downward by $11.00 per ADMT. All costs are forecast by RISI.

(4)Projected Net Economic Rents = HBKP prices – ave. variable costs – opportunity cost of capital.

Table 4.11

CURRENT AND PROJECTED ECONOMIC RENTS FOR CTMP (chemi-thermomechanical pulp)

(Can.$ per air dry metric tonne (ADMT) pulp, current $s)

Year	CTMP Prices	Ave. Variable Costs	Rents Before Capital Costs	Opp. Cost of Capital	Projected Net Economic Rent
1989	758.63	417.00	341.63	97.20	244.43
1990	642.60	435.75	206.85	189.77	17.08
1991	632.78	417.00	215.78	n.a.	n.a.
1992	577.37	427.50	149.87	n.a.	n.a.
1993	604.81	455.25	149.56	n.a.	n.a.
1994	676.19	475.50	200.69	n.a.	n.a.
1995	657.94	485.83	172.11	n.a.	n.a.
1996	687.75	496.16	191.59	n.a.	n.a.
1997	714.75	506.49	208.26	n.a.	n.a.
1998	742.50	516.81	225.69	n.a.	n.a.

Source: Pulp and Paper Review, December 1989; Pulp and Paper Week, Vol.12,No.48, December 15–21, 1990; Resource Information Systems Inc.

Notes: n.a. – not available

(1)CTMP prices are as reported in Pulp and Paper Week (various issues) for Canadian bleached chemi-thermomechanical (softwood) delivered in U.S. markets.
Price projections for 1991 to 1998 assume as per industry analyst Rod Young (RISI) that CTMP prices are roughly 75 per cent of BKP prices.

(2)Variable Costs of production for CTMP are estimated at 75 percent of kraft pulp production costs
as per personal conversation with Rodney Young, Resource Information Services Inc. on April 4, 1991.
There is currently no publicly available CTMP production cost data however, RISI plans to begin
reporting and forecasting this information by the end of 1991.

(3)Capital costs are also estimated at 75 per cent of softwood bleached kraft pulp mill capital costs.
These figures are based on comparison of capital costs of new pulp mills to production capacity for CTMP and BKP mills respectively.

C.3 Rents from Plywood and Other Panelboard Production

Rents for plywood, oriented strandboard (OSB) / waferboard , and medium density fibreboard (MDF) are also imputed. Table 4.12 shows the rents for OSB and waferboard production. Waferboard was being produced from 1979 to 1982 and OSB produced from 1983 to 1990. OSB became a substitute for waferboard and plywood in the construction industry during this period. Therefore, the rents imputed represent both waferboard rents and OSB rents respective of production periods. Prices are mill net, FOB (for Ontario/Quebec mills) based on a composite of North Central U.S. market prices (accounting for 68 percent of Alberta's production shipments) and Canadian prices (Canadian markets account for roughly 32 percent of Alberta's production shipments). Average variable costs of production are respective of waferboard and OSB production and are based on Ontario/ Quebec mill costs (see table 7.0, appendix). Costs include delivered wood costs (stumpage and other forestry charges, reforestation, and other costs included), labour, energy, supplies, and administrative overhead costs. According to Tom Grawbowski of Silvacom Ltd., Edmonton (personal communication on February 20, 1991) Ontario/Quebec mills typically have higher labour costs and higher wood costs than Alberta mills however, Alberta producers face higher transportation costs. The two factors may be offsetting, thus we assume that using Ontario/Quebec costs provides a reasonable proxy for Alberta costs. Capital costs are based on the assumption that OSB/Waferboard producers face similar capital costs as do plywood and veneer producers, as per table 4.4.

The imputed OSB/Waferboard rents show rather significant rents during the entire study period except for negative rents in 1988 and 1990 when prices were dramatically depressed.

Table 4.13 shows plywood rents. Prices are mill net, FOB for Canadian softwood plywood for Alberta plywood mills with deliveries to Edmonton and other Canadian markets. The majority of Alberta plywood is consumed in-province or in other neighbor provinces. Average variable costs of production were not available for Alberta and B.C. plywood mill production costs were used as a proxy. Average variable costs include delivered wood costs (including stumpage and other forestry charges), labour, energy, supplies and administration overhead (see table 8.0

Table 4.12

ESTIMATES OF ECONOMIC RENTS IN ALBERTA'S OSB (Oriented Strandboard) & WAFERBOARD INDUSTRY

($ per thousand square feet (Msf), 3/8 inch basis, in current $s)

Year	OSB/Waferboard Prices	Ave. Variable Costs	Rent Before Capital Costs	Opp. Cost of Capital	Estimated Net Economic Rent
1979	191.61	70.34	121.27	25.22	96.05
1980	169.59	83.65	85.94	26.34	59.60
1981	137.30	88.98	48.32	25.55	22.77
1982	133.32	91.11	42.21	25.75	16.46
1983	149.28	113.89	35.39	22.68	12.71
1984	160.45	119.46	40.99	22.07	18.92
1985	176.71	122.49	54.22	19.79	34.43
1986	168.25	117.36	50.89	20.39	30.50
1987	165.24	117.99	47.25	22.83	24.42
1988	126.71	123.02	3.69	25.88	-22.19
1989	165.55	125.33	40.22	29.94	10.28
1990	128.57	126.52	2.05	31.71	-29.66
Averages	156.05	108.35	47.70	24.85	22.86

Source: FORISM Review (various issues) and FORISM Yearbook, Resource Information Systems Inc.(R.I.S.I)., and Statistics Canada Cat.No. 25-201,25-202, 35-250 Annual.

Notes: All figures are respective of production of Waferboard from 1979 to 1982 and OSB from 1983 to 1990.

(1)O.S.B./Waferboard Prices ($/Msf 3/8") are Net FOB Mill prices based on a composite of 68 percent of the North Central U.S. market prices and 32 percent Canadian prices based on OSB export market information from Bamsey, C.R. (1989) Directory of Primary Wood Using Industries in Alberta.

(2)Average variable costs of production for Alberta are estimated based on RISI cost data for Ontario/Quebec OSB/Waferboard mills (see table__ appendix __) RISI cost data for Ontario/Quebec OSB/Waferboard mills (table 7.0 (appendix)). Costs include delivered wood costs (including stumpage, reforesation, and other expenses), labour, energy, supplies, and administration costs. In personal conversation with Tom Grawbowski, Silvacom Ltd, Edmonton, February 20, 1991 Ontario/Quebec mills typically have higher labour and wood costs than Alberta mills. While capital costs are similar across North America, Alberta mills may incur a small premium because of climatic (winter) operating conditions.

(3)Opportunity Cost of Capital are assumed to be similar to plywood industries (see table 4.4).)

(4)Estimated economic rent=price-average variable costs-opportunity cost of capital.

Table 4.13

ESTIMATES OF ECONOMIC RENTS IN ALBERTA'S PLYWOOD INDUSTRY

($ per thousand square feet (Msf) on a 3/8 inch basis, in current $s)

Year	Canada Softwood Plywood Prices	Ave. Variable Costs	Rents Before Capital Costs	Opp. Cost of Capital	Estimated Economic Rent
1979	198.00	167.00	31.00	25.22	5.78
1980	181.00	175.00	6.00	26.34	-20.34
1981	207.00	193.00	14.00	25.55	-11.55
1982	163.00	207.00	-44.00	25.75	-69.75
1983	201.00	189.00	12.00	22.68	-10.68
1984	181.00	193.00	-12.00	22.07	-34.07
1985	206.00	188.00	18.00	19.79	-1.79
1986	265.00	189.00	76.00	20.39	55.61
1987	249.00	206.00	43.00	22.83	20.17
1988	227.00	217.00	10.00	25.88	-15.88
1989	246.00	218.00	28.00	29.94	-1.94
1990	257.00	223.00	34.00	31.71	2.29
Averages	215.08	197.08	18.00	24.85	-6.85

Source: FORSIM Year Book (1990), Resource Information Services Inc; The Alberta Forest Industry Report, Silvacom.

Notes: (1) Canadian softwood plywood prices are $/Msf, 3/8 inch basis, net FOB mill delivered to Edmonton and other Canadian markets.

(2) Average variable costs of production for Alberta plywood mills are not available from any sources and are therefore estimated based on British Columbia plywood mill production costs reported by RISI (see table 8.0 (appendix)). Average variable costs include delivered wood costs (including stumpage, reforestation, and other expenditures), labour, energy, supplies, and administrative overhead.

Residue income from the production of wood chips and shavings is netted out of costs.

(3) Opportunity Cost of Capital is as per table 4.4.

(4) Estimated economic rent=price–average variable costs–opportunity cost of capital.

Table 4.14

ESTIMATES OF ECONOMIC RENTS FROM ALBERTA MDF PRODUCTION

($ Canadian per thousand square feet (Msf) on a 3/4 inch basis, in current $s)

Year	U.S. West MDF Prices Prices	Ave. Variable Costs	Rents Before Capital Costs	Opp. Cost of Capital	Estimated Net Economic Rent
1986	429.51	277.86	151.65	40.78	110.87
1987	412.30	263.87	148.43	45.66	102.77
1988	388.68	264.45	124.23	51.76	72.47
1989	364.62	265.15	99.47	59.88	39.59
1990	374.85	281.67	93.18	63.42	29.76
Averages	393.99	270.60	123.39	52.30	71.09

Source: FORSIM Year Book (1990), Resource Information Services Inc.

Notes: MDF is medium density fibreboard. Only one MDF mill in Alberta producing since 1986.

(1) Prices and average variable costs of production are based onWestern U.S. MDF industry converted to Canadian dollars.

No publicly available data for Alberta or Canadian MDF mills are available.

(2) Average variable costs of production include material expenses (wood, resin, wax), labour, electricity and supplies.

Wood inputs are chips, shavings and sawdust. It is speculated that Western U.S. production costs are higher than in Alberta due to lower wood costs and lower energy cost

(3) In the absence of MDF capital cost data, plywood opportunity cost of capital is used as a proxy.

(4) Estimated economic rent = price – average variable costs – opportunity cost of capital.

(5) Alberta MDF markets are Pacific Rim (40 percent), Europe (25 percent), Western Canada (20 percent) and Eastern Canada (10 percent)

from 1987 to 1990 (Source: Bamsey, C.R. (1989). Directory of Wood Using Industries in Alberta – 1988; Alberta Economic Development and Trade.)

appendix). Residue income from the sale of shavings and wood chips is netted out of costs. The opportunity cost of capital is from table 4.4. The results are significant because they appear to indicate negative rents in every year except 1979, 1986, 1987 and 1990, a result far different than for OSB. Using B.C. cost data may overestimate Alberta costs thus causing some problems but we can not be sure. Plywood production in Alberta has remained relatively static during the study period with declining production relative to OSB and other panel products expected by RISI into the 1990s.

Table 4.14 shows rents for medium density fibreboard or MDF production. Prices are based on Western U.S. MDF prices reported by RISI and converted to Canadian dollars. Alberta MDF markets are roughly 40 per cent to the Pacific Rim, 25 per cent to Europe, 20 per cent to Western Canada and 10 per cent to Eastern Canada (Bamsey, 1987). MDF has been produced since 1986 by one plant. Average variable costs of production include material expenses (wood, resin, wax), labour, electricity, and supplies. Wood inputs are primarily purchased chips, shavings and sawdust and are based on U.S. MDF production costs converted to Canadian dollars. We would expect U.S. costs to be slightly higher due to higher wood costs and higher energy costs. The rents imputed show significant positive rents for MDF production for all years 1986 to 1990.

C.4 Summary of Residual Valuation Rent Estimations

The results of residual valuation rent imputation are shown in tables 4.15 to 4.17 . All figures are shown in constant 1986 dollars using the Canadian GDP implicit price index (see table 13, appendix). Table 4.15 summarizes the previous analysis showing the forestry rents on a per unit product output basis generated by each industry or product classification. Table 4.16 provides an estimate of the total rents generated based on estimated production of forest products. Total economic rent values are imputed by multiplying the rents on a per unit of production basis by the volumes of forest products produced in each period. Production figures are shown in tables 9.0 and 10.0 (appendix) based on Statistics Canada reported production figures for

Table 4.15

SUMMARY OF ECONOMIC RENTS IN ALBERTA'S FOREST INDUSTRY PER UNIT OF OUTPUT

(constant 1986 dollars per unit of output) ***Residual Valuation Approach***

Year		Pulp and Paper							
	Lumber	Weighted (1) Total Pulp	SBKP	HBKP	CTMP	Newsprint	Plywood	Waferboard & OSB	MDF
Units	($/Mfbm)	($/ADMT)	($/ADMT)	($/ADMT)	($/ADMT)	($/tonnes)	$/Msf, 3/8"	$Msf, 3/8"	$Msf, 3/4")
1979	79.26	102.21	102.21	n.a	n.a	n.a	8.76	145.53	n.a
1980	3.01	109.88	109.88	n.a	n.a	n.a	-27.86	81.64	n.a
1981	-7.59	58.85	58.85	n.a	n.a	n.a	-14.28	28.15	n.a
1982	-64.44	-8.36	-8.36	n.a	n.a	n.a	-79.35	18.73	n.a
1983	6.84	-79.86	-79.86	n.a	n.a	n.a	-11.57	13.77	n.a
1984	-18.75	67.48	67.48	n.a	n.a	n.a	-35.79	19.87	n.a
1985	-15.22	32.96	32.96	n.a	n.a	n.a	-1.83	35.24	n.a
1986	4.35	27.75	27.75	n.a	n.a	n.a	55.61	30.50	110.87
1987	16.92	167.69	167.69	n.a	n.a	n.a	19.25	23.30	98.06
1988	3.62	218.78	218.78	n.a	n.a	n.a	-14.45	-20.19	65.94
1989	-27.20	231.92	239.93	156.60	212.18	n.a	-1.68	8.92	34.37
1990	-40.34	66.11	114.36	-27.78	14.37	58.03	1.93	-24.95	25.03
Average	-4.96	82.95	87.64	64.41	113.27	58.03	-8.44	30.04	66.85

n.a. – not applicable; n/a – not available.

(1) Weighted according to the relative volume of production

(2) Constant 1986 dollars are calculated using Canadian Implicit Price Index for Gross Domestic Product.

Table 4.16

TOTAL ECONOMIC RENTS IN ALBERTA'S FOREST INDUSTRY BY PRODUCT

(constant 1986 dollars) ***Residual Valuation Approach***

Year	Lumber	Pulp and Paper Total Pulp	SBKP	HBKP	CTMP	Newsprint	Plywood	Waferboard & OSB	MDF	TOTAL FOREST PRODUCTS
1979	79,194,170	50,083,939	50,083,939	0	0	0	1,313,636	18,191,288	0	148,783,033
1980	3,185,781	53,839,589	53,839,589	0	0	0	(4,876,027)	10,205,479	0	62,354,822
1981	(9,093,120)	28,836,712	28,836,712	0	0	0	(2,855,377)	3,518,232	0	20,406,447
1982	(70,139,522)	(4,200,956)	(4,200,956)	0	0	0	(15,870,307)	2,340,728	0	(87,870,057)
1983	10,629,239	(43,714,901)	(43,714,901)	0	0	0	(2,580,325)	3,511,430	0	(32,154,557)
1984	(27,778,125)	39,266,025	39,266,025	0	0	0	(7,980,683)	7,412,983	0	10,920,201
1985	(25,192,246)	20,348,291	20,348,291	0	0	0	(409,300)	13,144,719	0	7,891,464
1986	7,888,725	16,516,800	16,516,800	0	0	0	12,790,300	11,315,500	5,289,608	53,800,933
1987	37,381,878	106,242,208	106,242,208	0	0	0	4,426,622	14,151,017	4,903,149	167,104,874
1988	8,506,118	142,413,990	142,413,990	0	0	0	(3,222,238)	(13,366,497)	3,297,088	137,628,462
1989	(59,973,116)	190,283,235	146,837,500	0	21,722,868	0	(381,670)	5,907,252	1,718,316	115,831,150
1990	(87,818,586)	86,135,796	84,386,596	(4,153,613)	2,951,407	3,481,918	436,508	(16,513,311)	1,251,472	(15,977,610)
Average	(11,100,734)	57,170,894	53,404,649	(4,153,613)	12,337,137	3,481,918	(1,600,738)	4,984,902	3,291,927	49,059,930

Notes: SBKP is softwood bleached kraft pulp, HBKP is hardwood bleached kraft pulp, CTMP is chemi-thermomechanical pulp, OSB is oriented strandboard; MDF is medium density fibreboard.

(1) Total economic rents by industry = economic rent per unit of production x total estimated production. These figures include the opportunity cost of capital.

(2) Total primary forest products excludes some minor forest products such as construction board, insulation board, posts and poles, firewood, crates and pallets. Also excludes secondary wood-using industry products.

Table 4.17

SUMMARY OF ECONOMIC RENTS IN ALBERTA'S FOREST INDUSTRY PER UNIT OF WOOD INPUT

(constant 1986 dollars per unit of wood input) ***Residual Valuation Approach***

Year		Pulp and Paper								
		Weighted (1)						Waferboard		TOTAL
	Lumber	Total Pulp	SBKP	HBKP	CTMP	Newsprint	Plywood	& OSB	MDF	FOREST
Units	(Mfbm)	(ADMT)	(ADMT)	(ADMT)	(ADMT)	(tonnes)	(Msf, 3/8")	(Msf, 3/8")	(Msf, 3/4")	PRODUCTS
1979	18.47	18.26	18.26	n.a	n.a	n.a	5.87	79.61	n.a	19.88
1980	0.70	19.62	19.62	n.a	n.a	n.a	-18.67	44.66	n.a	8.03
1981	-1.77	10.51	10.51	n.a	n.a	n.a	-9.57	15.40	n.a	2.42
1982	-15.01	-1.49	-1.49	n.a	n.a	n.a	-53.17	10.24	n.a	-10.97
1983	1.59	-14.26	-14.26	n.a	n.a	n.a	-7.75	8.10	n.a	-3.02
1984	-4.37	12.05	12.05	n.a	n.a	n.a	-23.98	11.69	n.a	1.02
1985	-3.55	5.89	5.89	n.a	n.a	n.a	-1.23	20.72	n.a	0.67
1986	1.01	4.96	4.96	n.a	n.a	n.a	37.26	17.93	24.64	4.01
1987	3.94	29.95	29.95	n.a	n.a	n.a	12.89	13.70	21.79	11.55
1988	0.84	39.07	39.07	n.a	n.a	n.a	-9.68	-11.87	14.65	9.04
1989	-6.34	49.75	42.85	38.84	78.59	n.a	-1.13	5.25	7.64	7.74
1990	-9.40	23.42	20.42	-6.89	5.32	21.50	1.29	-14.67	5.56	-0.03
Average	-1.16	16.48	15.65	15.97	41.96	21.50	-5.65	16.73	14.85	4.19

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n.a. – not applicable; n/a – not available.

(1)Rents per unit of wood input are imputed using conversion factors: Lumber (0.233 Mfbm/cubic meter wood input);
SBKP (0.1786 ADMT/cubic meter wood input); HBKP (0.2480 ADMT/cubic meter wood input);
CTMP and Newsprint (0.3704 ADMT/cubic meter wood input); OSB (0.588 thousand square feet (Msf, 3/8")/ cubic meter wood input);
Waferboard (0.547 Msf(3/8")/ cubic meter wood input); Plywood (0.67 Msf/cubic meter wood input);
MDF (0.700 Msf (3/4")/cubic meter wood input)

(2)Conversion factors are from Alberta Forest Service, Alberta Forestry, Lands and Wildlife.

(3)Constant 1986 dollars are calculated using Canadian Implicit Price Index for Gross Domestic Product.

Alberta.[57] Plywood, OSB/Waferboard and MDF production figures are taken from several sources, primarily Bamsey (1986 and 1988). Table 4.17 shows these results on a per cubic meter of wood input basis, where total rents are converted to per cubic meter rents using Alberta forest product conversion factors (see tables 10.0 and 12.0.0, appendix)

The results show considerable variability in forest rents by product with lumber and plywood actually generating negative rents, on average, and pulp products generating significant positive rents. Average economic rents in constant 1986 dollars are -$11.1 million for lumber, +$57.2 million for total pulp, +$3.5 million for newsprint, -$1.6 million for plywood, +$5.0 million for OSB/Waferboard, and +$3.29 million for MDF for the period 1979 to 1990. Total Alberta forestry rents in constant dollars averaged $49.1 million during the study period, that is, net of indirect taxes. From this analysis it is apparent that pulp production generates the largest share of total economic rents in Alberta's forest industry.

The per cubic meter of wood input rent results reveal that over the twelve year study period, pulp and OSB/Waferboard generated $16.48 and $16.73 per cubic meters of rent respectively on a constant dollar basis. Again, these figures represent rents in excess of stumpage fees and other forestry charges and are as such windfall rents. Again, lumber and plywood rents were negative on a per cubic meter basis. The average rents (in constant dollars) for the total Alberta forest industry production from 1979 to 1990 was $4.19 per cubic meter. This lower rent figure for total forest products is a weighted average figure and reflects the considerable importance of lumber production volumes.

The results of rent imputation using the residual valuation approach suggest considerable variability in rents for respective products though in aggregate rents in the Alberta forest industry. The results are important because they indicate that some conversion of forest products generate more value than others.

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[57] As a caveat, it should be noted that there is apparently considerable uncertainty surrounding the exact production figures for Alberta as noted in the discrepancy between Statistics Canada data, Alberta government data (Alberta Forest Service) and other industry associations data (Alberta Forest Products Association). However, to remain consistent throughout our analysis and to allow for comparisons between residual valuation and value added rent imputations , we use Statistics Canada.

D. Value Added Approach to Imputing Alberta Forestry Rents

The second methodology used to impute forestry rents in the forestry sector of Alberta uses an approach adopted by both Percy (1986) and Copithorne (1979), in which rents are estimated more indirectly based on the difference between value-added and the shadow prices of labour and capital inputs. One of the benefits of this approach is that it is less data intensive relying primarily on Statistics Canada data. The general formula for rent imputation is:

Rent = value added - labour costs - opportunity cost of capital

$$R = V_{w,p,f} - L_{w,p,f} - C_{w,p,f} \quad (6)$$

Where 'V' is the value added figure for wood product industries (*w*), paper and allied product industries (*p*), and forestry (logging) industries (*f*), 'L' is the labour costs (wages and salaries) for each of the sectors, *w,p*, and *f*, and 'C' is the opportunity cost of capital associated with *w,p*, and *f* (taken from tables 4.2 to 4.6). Strictly speaking the complete formula for comparison with the residual valuation results should include a deduction of indirect taxes (stumpage charges and other forestry charges) however, this will be considered in the section comparing rent estimation results. In our analysis we attempted to further disaggregate the data for wood industries (*w*) into sawmill and planning mills and plywood, veneer and other panelboard products. Pulp and paper mills were also disaggregated from paper and allied (*p*) as best as possible. This disaggregation is necessary because the limited number of firms competing in Alberta's forest industries (with the exception of sawmills and planing mills) requires that Statistics Canada maintain confidentiality of data. Thus the disaggregated results may not be entirely accurate in the case of pulp and paper industries and veneer and plywood industries. However, aggregates for wood industries and paper and allied industries for Alberta were available, though these figures contain both primary and secondary wood-using industries.[58]

We define value added as the value added of total activity which is defined by Statistics Canada as value added in manufacturing activity plus the value added in non-manufacturing activity. Value added in manufacturing activity is a measure of the value of net output as calculated by shipments of goods of own manufacture plus the net change in inventories of goods in process and finished goods, less the cost of materials, supplies, fuel and electricity purchased and used. It includes production subsidies and excludes indirect taxes. It does not however include administrative overhead costs. Value added from non-manufacturing activity is calculated by subtracting the corresponding commodity inputs from non-manufacturing revenues and outputs. Activities accounted for include fixed capital formation and rental of a firms own products. It does not include rental revenues, dividends and interest. Total activity value added excludes indirect taxes (for example, stumpage and forestry charges) except property and business taxes and includes subsidy payments to industry. Using these figures for imputing rents would be expected to provide rather robust results because of the completeness of data used by Statistics Canada and because data is based on a census of manufacturing industry activities. In addition, using these values provides us a potentially more accurate total economic rent estimate because, value added figures are based on production provided in the industry census data.

Our approach to rent imputation using value added differs somewhat from the Copithorne (1979) and Percy (1986) studies in that, rather than deriving a shadow price for labour costs (as was done for British Columbia where rents were suspected of being captured by labour in the form of union wages), we use actual salaries and wages reported by Statistics Canada for the Alberta forestry manufacturing sector. Also, the imputed opportunity cost of capital is likely more robust than that used in these previous studies because it uses a derived opportunity cost of capital rate of return rather than one that is arbitrarily chosen.

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[58] A further caveat, is that some data for 1988 to 1990 was estimated based on projections of value of shipments for Alberta forest products by Statistics Canada. Statistics Canada forecasts this data based on 1987 industry census data and therefore, the figures are not actual.

D.1 Rents in Alberta's Forest Industries - Value Added Approach

The results of forestry rents estimated using the value added approach are presented in tables 4.18 to 4.20. Table 4.18 shows the economic rents and variable component data for value added of total activity, salaries and wages, and opportunity cost of capital. The results are ordered sequentially according to the Standard Industrial Classification (S.I.C.) of Statistics Canada for forest industries which includes logging (forestry) industries[59]; sawmill and planing mills; veneer, plywood, and other panelboard industries; wood industries, which is the aggregate of sawmills and plywood mills (that accounted for an average 57 per cent of the total value added of wood industries) together with other wood-using industries not otherwise captured by these first two categories (that is, 43 per cent); pulp and paper mills; paper and allied industries (that includes pulp and paper mills (on average accounting for 63 per cent of paper and allied industry total activity value added) plus other secondary pulp and paper using industries; and finally, the total forest industry figures which is logging plus wood industries plus paper and allied industries.

The results, which are summarized in table 4.19, show that in constant 1986 dollars the average economic rents during the period 1979 to 1990 in the logging industries were $12.3 million, $8.4 million in sawmill and planing mill industries, $8.7 million in plywood and panelboard industries, and $24.4 million in pulp and paper industries. The table also shows rents of $67.9 million on average for total wood industries, which includes primary and secondary wood industries. What is evident, is the significant contribution of secondary wood using industries to economic rent in the wood industries sector. Rents of $64.2 million for total paper and allied industries are indicated, also suggesting the importance of secondary paper product manufacturing industries. The last two columns represent total forest industry rents where VADD(1) is the valued added rent results for the primary forest manufacturing activity and VADD(2) are the rents generated by both primary and secondary manufacturing. VADD(1) rents were an average $53.9 million compared to $144.4 million for VADD(2).

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[59] It should be noted that throughout the valued added approach for determining rents we assume that the majority of logging activity is associated with pulp and paper production as is evident from examining the Statistics Canada surveyed logging firms in Alberta.

Table 4.18

ALBERTA FOREST INDUSTRY ECONOMIC RENTS (VALUE-ADDED APPROACH)

($ millions, current)

Industry	Year	Value Added Total Activity	Salaries & Wages of Total Activity	Opportunity Cost of Capital	Estimated Net Economic Rent
Logging	1979	35.9	21.7	6.4	7.8
	1980	35.5	22.2	7.5	5.8
	1981	48.1	23.9	8.5	15.7
	1982	35.0	23.0	8.6	3.4
	1983	33.0	20.0	8.3	4.7
	1984	30.0	21.0	7.9	1.1
	1985	32.0	22.0	7.4	2.6
	1986	46.0	29.0	7.2	9.8
	1987	68.0	32.0	7.1	28.9
	1988	73.0	39.0	7.3	26.7
	E 1989	59.8	35.3	8.1	16.4
	E 1990	78.0	46.1	8.5	23.4
Average		47.9	27.9	7.7	12.2
Sawmills &	1979	94.3	41.0	27.8	25.6
Planning Mills	1980	60.0	44.2	33.0	-17.2
(SIC 2512)	1981	58.6	53.7	40.5	-35.5
	1982	35.8	48.0	41.7	-53.9
	1983	112.0	63.0	43.6	5.4
	1984	114.0	72.0	43.9	-1.9
	1985	111.0	71.0	41.8	-1.8
	1986	145.0	74.0	48.4	22.6
	1987	168.0	86.0	52.1	29.9
	1988	207.2	100.5	55.2	51.5
	E 1989	225.7	107.3	65.5	52.9
	E 1990	240.0	112.6	73.6	53.8
Average		131.0	72.8	47.3	10.9

Table 4.18 (continued)

ALBERTA FOREST INDUSTRY ECONOMIC RENTS (VALUE-ADDED APPROACH)

($ millions, current)

Industry	Year	Value Added Total Activity	Salaries & Wages of Total Activity	Opportunity Cost of Capital	Estimated Net Economic Rent
Veener &	1979	19.3	7.7	3.8	7.8
Plywood Mills	1980	13.3	7.9	4.6	0.9
Particleboard &	1981	18.7	9.0	5.1	4.7
Waferboard	1982	15.5	9.7	5.2	0.6
(SIC 252, 2592,	E 1983	20.7	10.7	5.1	4.9
2593)	E 1984	14.4	11.3	4.9	-1.8
	E 1985	15.0	10.0	4.4	0.6
	E 1986	27.1	15.1	4.7	7.3
	E 1987	42.0	23.9	5.2	12.9
	E 1988	61.6	34.7	5.8	21.1
	E 1989	66.9	37.6	6.8	22.5
	E 1990	74.5	39.9	7.2	27.4
Average		32.4	18.1	5.2	9.1
Wood Industries	1979	227.2	111.7	39.2	76.3
(SIC 25)	1980	200.6	117.7	45.8	37.0
	1981	248.8	142.9	54.2	51.7
	1982	158.0	127.0	55.9	-24.9
	1983	235.0	132.0	56.2	46.8
	1984	237.0	142.0	55.4	39.6
	1985	264.0	144.0	52.7	67.3
	1986	313.0	157.0	59.8	96.2
	1987	348.0	175.0	67.5	105.5
	1988	368.0	198.0	80.3	89.7
	E 1989	398.4	210.4	89.5	98.5
	E 1990	422.0	220.3	97.3	104.3
Average		285.0	156.5	62.8	65.7

Table 4.18 (continued)

ALBERTA FOREST INDUSTRY ECONOMIC RENTS (VALUE-ADDED APPROACH)

($ millions, current)

Industry	Year	Value Added Total Activity	Salaries & Wages of Total Activity	Opportunity Cost of Capital	Estimated Net Economic Rent
Pulp and	1979	70.6	25.5	34.7	10.5
Paper Mills	1980	88.4	24.4	39.2	24.8
(SIC 271)	1981	95.8	34.5	45.8	15.6
	1982	128.0	43.0	52.0	33.0
	E 1983	110.1	49.0	49.8	11.3
	E 1984	167.1	50.4	50.9	65.8
	E 1985	114.1	52.5	52.8	8.8
	E 1986	106.0	54.6	56.5	-5.1
	E 1987	177.1	57.4	58.3	61.4
	E 1988	222.3	62.3	60.7	99.3
	E 1989	221.5	89.7	95.1	36.6
	E 1990	242.8	98.4	239.4	-95.0
Average		145.3	53.5	69.6	22.3
Paper & Allied	1979	117.9	46.7	45.7	25.5
(SIC 27)	1980	145.6	46.3	51.5	47.8
	1981	170.1	61.0	60.1	49.0
	1982	196.0	69.0	67.9	59.1
	1983	165.0	70.0	65.2	29.8
	1984	224.0	72.0	66.7	85.3
	1985	203.0	75.0	69.1	58.9
	1986	186.0	78.0	74.2	33.8
	1987	262.0	82.0	76.2	103.8
	1988	342.0	89.0	79.5	173.5
	E 1989	351.9	105.6	125.2	121.1
	E 1990	385.8	115.7	317.5	-47.4
Average		229.1	75.9	91.6	61.7

Table 4.18 (continued)

ALBERTA FOREST INDUSTRY ECONOMIC RENTS (VALUE-ADDED APPROACH)

($ millions, current)

Industry	Year	Value Added Total Activity	Salaries & Wages of Total Activity	Opportunity Cost of Capital	Estimated Net Economic Rent
Total Forest Industries					
Alberta	1979	381.0	180.0	91.3	109.7
	1980	381.7	186.2	104.8	90.7
	1981	467.0	227.8	122.8	116.4
	1982	389.0	219.0	132.4	37.6
	1983	433.0	222.0	129.7	81.3
	1984	491.0	235.0	130.0	126.0
	1985	499.0	241.0	129.2	128.8
	1986	545.0	264.0	141.2	139.8
	1987	678.0	289.0	150.8	238.2
	1988	783.0	326.0	167.1	289.9
	E 1989	810.1	351.3	222.8	236.0
	E 1990	885.8	382.2	423.3	80.3
Average		562.0	260.3	162.1	139.6

Source: Statistics Canada Cat. No. 25-202, 25-201, 35-250, 36-250.

E – estimated or projected based on past rents

(1) Estimated Net Economic Rent = Value Added of Total Activity – Wages and Salaries of Total Activity – Opportunity Cost of Capital.

(2) Total Forest Industries Alberta = logging + wood industries + pulp and allied industries.

(3) Pulp and paper industry data for 1983 to 1990 were estimated because unavailable from Statistics Canada because of confidentiality; other years are actual figures.

Table 4.19

SUMMARY OF ALBERTA FORESTRY ECONOMIC RENTS (VALUE-ADDED APPROACH)

(millions of constant 1986 dollars)

Year	Logging	Sawmills & Planing Mills	Plywood & Other Panelboards	Total Wood Industries	Pulp and Paper Industries	Paper & Allied	Total Forest Industries	
							VADD(1)	VADD(2)
1979	11.8	38.8	11.8	115.6	15.9	38.6	78.3	166.1
1980	7.9	-23.6	1.2	50.7	34.0	65.5	19.6	124.1
1981	19.4	-43.9	5.8	63.9	19.3	60.6	0.6	143.9
1982	3.9	-61.3	0.7	-28.3	37.5	67.2	-19.2	42.8
1983	5.1	5.9	5.3	50.7	12.2	32.3	28.5	88.1
1984	1.2	-2.0	-1.9	41.6	69.1	89.6	66.4	132.4
1985	2.7	-1.8	0.6	68.9	9.0	60.3	10.4	131.8
1986	9.8	22.6	7.3	96.2	-5.1	33.8	34.6	139.8
1987	27.6	28.5	12.3	100.7	58.6	99.0	127.0	227.3
1988	24.3	46.9	19.2	81.6	90.4	157.9	180.7	263.8
1989	14.2	45.9	19.5	85.5	31.8	105.1	111.5	204.9
1990	19.7	45.2	23.0	87.7	-79.9	-39.9	8.1	67.5
Averages	12.3	8.4	8.7	67.9	24.4	64.2	53.9	144.4

(1) Constant dollar conversion is using Canadian Implicit Price Index, Gross Domestic Product, 1986=100.0

(2) Total Forest Industries VADD(1) = Logging + Sawmills + Plywood & Panelboard + Pulp and Paper

(3) Total Forest Industries VADD(2) = logging + total wood industries + paper and allied industries.

Table 4.20

SUMMARY OF ALBERTA FORESTRY ECONOMIC RENTS PER UNIT OF WOOD INPUT

(constant 1986 dollars per cubic meter wood input) *Value Added Approach*

Year	Logging	Sawmills & Planing Mills	Plywood & Other Panelboards	Total Wood Industries	Pulp and Paper Industries	Paper & Allied	Total Forest Industries VADD(1)	Total Forest Industries VADD(2)
1979	4.31	9.04	26.12	24.39	5.80	14.08	10.47	22.19
1980	2.90	-5.19	2.52	10.08	12.38	23.87	2.52	15.97
1981	7.07	-8.53	11.02	11.27	7.03	22.08	0.07	17.10
1982	1.37	-13.13	1.30	-5.45	13.35	23.90	-2.40	5.34
1983	1.68	0.88	6.93	6.82	4.04	10.65	2.72	8.41
1984	0.36	-0.31	-1.95	5.68	21.32	27.64	6.28	12.53
1985	0.78	-0.26	0.63	8.53	2.64	17.65	0.91	11.48
1986	2.94	2.90	7.49	10.98	-1.53	10.14	2.86	11.56
1987	7.77	3.01	8.52	9.21	16.52	27.92	8.79	15.72
1988	6.67	4.65	12.55	7.03	24.79	43.32	11.86	17.32
1989	3.62	4.85	12.72	7.78	8.08	26.73	7.66	14.09
1990	4.08	4.84	15.01	8.06	-16.58	-7.35	0.54	4.50
Averages	3.63	0.23	8.57	8.70	8.15	20.05	4.36	13.02

(1) Constant dollar conversion is using Canadian Implicit Price Index, Gross Domestic Product, 1986=100.0

(2) Total Forest Industries VADD(1) = Logging + Sawmills + Plywood & Panelboard + Pulp and Paper

(3) Total Forest Industries VADD(2) = logging + total wood industries + paper and allied industries.

(4) Logging rents use pulp production wood inputs.

These results are also shown on a per cubic meter of wood input basis, in constant 1986 dollars, in table 4.20. The results show the lowest rents are from lumber production ($0.23 per cubic meter) and the highest in paper and allied industries ($20.05 per cubic meter) . Rents in the primary forest manufacturing industries (VADD(1)) including, logging, sawmills, plywood and panelboard, and pulp and paper industries averaged $4.36 per cubic meter of wood input compared with $13.02 per cubic meter for the entire forest industry, primary and secondary forest product industries (VADD(2)).

Negative rents were realized by lumber producers in five of the twelve years analyzed corresponding in part to recessions in the U.S. and Canadian economies. The significant drop in rents in 1990 in the pulp and paper, and paper and allied sector is indicative of the the treatment of capital costs during a period of tremendous capital expansion . The results shows a lag effect where productive capacity lags actual capital expenditures by roughly one to two years. We would otherwise expect rents to be similar to pre-1989 levels in constant dollars because pulp prices were in fact higher in 1990 than in any other previous period .

Since total activity value added figures exclude indirect taxes, such as stumpage and other forestry charges, it is necessary to deduct these from our value added rent calculations. Since we only have indirect tax data for the entire forest industry it is only possible to deduct these from our total forest industry rent figures. The results of netting out indirect taxes are shown in the following section comparing the two methods.

E. Comparison of Residual Valuation and Value Added Rent Estimates

Comparing the rent imputation results of the residual value approach with the value added approach can provide some indication of the range of rent values generated by Alberta's forest industry. It is not however, possible to conclude that one set of results are more robust than another because both have respective inherent weaknesses. Nevertheless, these results do provide the best possible estimates of rents despite limitations of the data.

Table 4.21 shows the comparison of the results in constant 1986 dollars. These are illustrative in a bar graph in figure 6. The results are from previous tables and show residual valuation and value added rents (VADD(1) and VADD(2)). Rents are broken down by logging, sawmills, panelboard (plywood, OSB/Waferboard), total wood industries, total pulp, paper and allied industries, and total forest industries. Indirect taxes are netted out of the value added rent figures for comparison with the residual valuation results and results are shown as "net economic rents." That is, net economic rents is in essence the windfall rents accruing to firms from forest production before direct taxes.[60]The comparison of results shows considerable contrast, at least when comparing individual sector rents, even though this comparison is not exact because of the difficulty in disaggregating indirect taxes to respective forest industries in the case of value added rents. According to macroeconomic theory and in accordance with Statistics Canada we would also have to add to the rent estimates any subsidies paid to the forest industry. Unfortunately, subsidy data specific to the Alberta forest industry is not available.

Comparison of results for lumber producers shows significant contrast; residual valuation rents, in constant 1986 dollars, were negative $11.1 million compared with positive $8.4 million using the valued added approach. While part of this discrepancy can be accounted for by the exclusion of indirect taxes in the value added figures, the differences are still significant. The nature of these differences can only be speculated, one may be that prices for Alberta lumber and wood chip sales used in the residual valuation results were too low.

Comparison of panelboard industry rents provides a closer fit with residual valuation rents estimated at $4.8 million and valued added rents at $8.7 million.

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[60] We have not considered the implication of direct taxes, including corporate income taxes, on these rents because we are interested in the "economic rent" which, as defined in the introduction, is the return to production over and above the required rate of return required by the firm.

Table 4.21

NET ECONOMIC RENTS IN ALBERTA'S FOREST PRODUCTS INDUSTRY

(constant 1986 thousand dollars)

Year	1979			1980			1981		
	RV	VADD(1)	VADD(2)	RV	VADD(1)	VADD(2)	RV	VADD(1)	VADD(2)
Logging	n.a.	11,818.0	11,818.0	n.a.	7,945.0	7,945.0	n.a.	19,407.0	19,407.0
Sawmills	79,194.2	38,787.9	n.a.	3,185.8	(23,561.6)	n.a.	(9,093.1)	(43,881.3)	n.a.
Plywood	1,313.6	11,818.2	n.a.	(4,876.0)	1,232.9	n.a.	(2,855.4)	5,809.6	n.a.
OSB/Waferboard	18,191.4	n/a	n.a.	10,205.5	n/a	n.a.	3,518.3	n/a	n.a.
MDF	0.0	n/a	n.a.	0.0	n/a	n.a.	0.0	n/a	n.a.
Total Panelboard	19,505.0	11,818.2	n.a.	5,329.5	1,232.9	n.a.	662.9	5,809.6	n.a.
Total Wood Industries	98,699.2	50,606.1	115,606.1	8,515.2	(22,328.8)	50,684.9	(8,430.2)	(38,071.7)	63,906.1
Total Pulp, Paper and Allied	50,083.9	27,727.0	50,455.0	53,839.6	41,918.0	73,425.0	28,836.7	38,690.0	79,975.0
Total Forest Industries	148,783.2	78,333.3	166,060.6	62,354.8	19,589.0	124,109.6	20,406.6	618.0	143,881.3
less Indirect Taxes	n.a	11,665.2	11,665.2	n.a	10,550.7	10,550.7	n.a	11,071.7	11,071.7
NET ECONOMIC RENTS									
(constant $, thousand)	148,783.2	66,668.2	154,395.5	62,354.8	9,038.4	113,558.9	20,406.6	(10,453.6)	132,809.6
(constant $ per cubic meter wood input)	19.88	8.91	20.63	8.02	1.16	14.61	2.43	-1.24	15.79

Notes: n/a – not available; n.a. – not applicable

(1)VADD(1) is value added rent figures for primary wood using industries only for example, VADD(1) for pulp, paper and allied includes only pulp and paper plus logging activity rents.

(2)VADD(2) are value added rent figures for both primary and secondary wood–using (forestry) manufacturing industries; VADD(2) for total pulp, paper and allied includes pulp and paper, allied,& logging a

(3)Pulp and Paper and Paper and Allied rents include logging activity rents; (4) Total Forest Industries = Total Wood Industries + Total Pulp, Paper and Allied.

(5)Net Economic Rents per cubic meter of wood input is total net economic rents (1986$=100) divided by apparent wood inputs (table 10.0, appendix).

(6)Normally macroeconomic theory for income accounting perscribes reporting of subsidies to industry as additions to net economic rents, however, these figures specific to Alberta's forest industry are unavailable from Statistics Canada.

Table 4.21 (continued)

Year	1982			1983			1984		
	RV	VADD(1)	VADD(2)	RV	VADD(1)	VADD(2)	RV	VADD(1)	VADD(2)
Logging	n.a.	3,868.0	3,868.0	n.a.	5,092.0	5,092.0	n.a.	1,155.0	1,155.0
Sawmills	(70,139.5)	(61,319.7)	n.a.	10,629.2	5,850.5	n.a.	(27,778.2)	(1,995.8)	n.a.
Plywood	(15,870.3)	682.6	n.a.	(2,580.3)	5,308.8	n.a.	(7,980.7)	(1,890.8)	n.a.
OSB/Waferboard	2,340.7	n/a	n.a.	3,511.4	n/a	n.a.	7,413.0	n/a	n.a.
MDF	0.0	n/a	n.a.	0.0	n/a	n.a.	0.0	n/a	n.a.
Total Panelboard	(13,529.6)	682.6	n.a.	902.0	5,308.8	n.a.	(567.6)	(1,890.8)	n.a.
Total Wood Industries	(83,669.1)	(60,637.1)	(28,327.6)	11,531.2	11,159.3	50,704.2	(28,345.8)	(3,886.6)	41,596.6
Total Pulp, Paper and Allied	(4,201.0)	41,411.0	71,104.0	(43,714.9)	17,335.0	37,378.0	39,266.0	70,273.0	90,756.0
Total Forest Industries	(87,870.3)	(19,226.4)	42,775.9	(31,702.3)	28,494.0	88,082.3	10,716.6	66,386.6	132,352.9
less Indirect Taxes	n.a	12,037.5	12,037.5	n.a	16,677.1	16,677.1	n.a	18,930.7	18,930.7
NET ECONOMIC RENTS									
(constant $, thousand)	(87,870.3)	(31,263.9)	30,738.3	(31,702.3)	11,816.9	71,405.2	10,716.6	47,455.9	113,422.3
(constant $ per cubic meter wood input)	-10.97	-3.90	3.84	-3.03	1.13	6.82	1.01	4.49	10.73

Table 4.21 (continued)

Year	1985			1986			1987		
	RV	VADD(1)	VADD(2)	RV	VADD(1)	VADD(2)	RV	VADD(1)	VADD(2)
Logging	n.a.	2,661.0	2,661.0	n.a.	9,800.0	9,800.0	n.a.	27,576.0	27,576.0
Sawmills	(25,192.2)	(1,842.4)	n.a.	7,888.7	22,600.0	n.a.	37,381.9	28,530.5	n.a.
Plywood	(409.3)	614.1	n.a.	12,790.3	7,300.0	n.a.	4,426.6	12,309.2	n.a.
OSB/Waferboard	13,144.7	n/a	n.a.	11,315.5	n/a	n.a.	14,151.0	n/a	n.a.
MDF	0.0	n/a	n.a.	5,289.6	n/a	n.a.	4,903.1	n/a	n.a.
Total Panelboard	12,735.4	614.1	n.a.	29,395.4	7,300.0	n.a.	23,480.8	12,309.2	n.a.
Total Wood Industries	(12,456.8)	(1,228.2)	68,884.3	37,284.1	29,900.0	96,200.0	60,862.8	40,839.7	100,667.9
Total Pulp, Paper and Allied	20,348.3	11,668.0	63,971.0	16,516.8	4,700.0	43,600.0	106,242.2	86,164.0	126,622.0
Total Forest Industries	7,650.7	10,440.1	132,855.7	53,800.1	34,600.0	139,800.0	167,105.1	127,003.8	227,290.1
less Indirect Taxes	n.a	17,808.6	17,808.6	n.a	18,555.0	18,555.0	n.a	36,982.8	36,982.8
NET ECONOMIC RENTS									
(constant $, thousand)	7,650.7	(7,368.5)	115,047.1	53,800.1	16,045.0	121,245.0	167,105.1	90,021.0	190,307.3
(constant $ per cubic meter wood input)	0.67	-0.64	10.01	4.43	1.32	9.99	11.56	6.23	13.16

Table 4.21 (continued)

Year	1988			1989			1990		
	RV	VADD(1)	VADD(2)	RV	VADD(1)	VADD(2)	RV	VADD(1)	VADD(2)
Logging	n.a.	24,295.0	24,295.0	n.a.	14,236.0	14,236.0	n.a.	19,680.0	19,680.0
Sawmills	8,506.1	46,860.8	n.a.	(59,973.1)	45,920.1	n.a.	(87,818.6)	45,248.1	n.a.
Plywood	(3,222.2)	19,199.3	n.a.	(381.7)	19,531.3	n.a.	436.5	23,044.6	n.a.
OSB/Waferboard	(13,366.5)	n/a	n.a.	5,907.3	n/a	n.a.	(16,513.3)	n/a	n.a.
MDF	3,297.1	n/a	n.a.	1,718.3	n/a	n.a.	1,251.5	n/a	n.a.
Total Panelboard	(13,291.6)	19,199.3	n.a.	7,243.9	19,531.3	n.a.	(14,825.3)	23,044.6	n.a.
Total Wood Industries	(4,785.5)	66,060.1	81,619.7	(52,729.2)	65,451.4	85,503.5	(102,643.9)	68,292.7	87,720.8
Total Pulp, Paper and Allied	142,414.0	114,650.0	182,166.0	190,283.2	46,007.0	119,271.0	89,617.7	(60,219.0)	(20,185.0)
Total Forest Industries	137,628.6	180,709.7	263,785.3	115,831.2	111,458.3	204,774.3	(15,977.5)	8,074.0	67,535.7
less Indirect Taxes	n.a	35,084.6	35,084.6	n.a	28,849.8	28,849.8	n.a	24,066.4	24,066.4
NET ECONOMIC RENTS									
(constant $, thousand)	137,628.6	145,625.1	228,700.6	115,831.2	82,608.5	175,924.5	(15,977.5)	(15,992.4)	43,469.3
(constant $ per cubic meter wood input)	9.03	9.56	15.01	7.96	5.68	12.10	-1.05	-1.05	2.85

Table 4.21 (continued)

Year	AVERAGES		
	RV	VADD(1)	VADD(2)
Logging	n.a.	12,294.4	12,294.4
Sawmills	(11,100.7)	8,433.1	n.a.
Plywood	(1,600.7)	8,746.6	n.a.
OSB/Waferboard	4,984.9	n/a	n.a.
MDF	3,291.9	n/a	n.a.
Total Panelboard	4,753.4	8,746.6	n.a.
Total Wood Industries	(6,347.3)	17,179.7	67,897.2
Total Pulp, Paper and Allied	57,461.0	36,693.7	76,544.8
Total Forest Industries	49,060.5	53,873.4	144,442.0
less Indirect Taxes	n.a.	20,190.0	20,190.0
NET ECONOMIC RENTS			
(constant $, thousand)	49,060.5	33,683.4	124,252.0
(constant $ per cubic meter wood input)	4.16	2.64	11.30

Comparing rents in total primary wood industries rent (includes sawmills and panelboard) figures shows a spread of roughly $20 million in constant dollars or negative $6.3 million in rents using residual valuation and $17.2 million using value added approaches. Value added rents for both primary and secondary wood using industries is considerably larger at $67.9 million averaged over the study period. The value added rent figures for primary and secondary wood industries show that secondary manufacturing generates roughly four times as much rent as primary wood industry manufacturing. Reasons for this difference will be discussed later.

The pulp and paper industry results show that residual valuation rent figures are more closely related to the value added figures. Total pulp and paper rents using the residual valuation approach reveals rents averaging $57.5 million, in constant dollars, from 1979-1990 compared to $36.7 million for value added rent in primary pulp and paper manufacturing and $76.5 million in primary plus secondary pulp and paper manufacturing (that is, paper and allied industries). These results show that in terms of value added rent, secondary manufacturing contributes slightly more than twice as much to rent generation than the primary manufacturing industries.

In comparing the net economic rents for total forest product rents the results are considerable more alike. The residual valuation approach reveals rents of $49.1 million, $33.7 million for the value added rent figures for primary forest product manufacturing, and $124.3 million for the value added rent figures for primary and secondary manufacturing.

In comparing the results it is useful to determine statistically the hypothesis of whether or not there is any correlation or relationship between both results. The imputed figures were put through a series of simple linear regression analysis using the Apple statistical software package, Statview to test the hypothesis. The following table 4.22 summarizes these results:

Table 4.22 OLS Regression Results of Rent Comparisons

Regression Variables Y	 X	R-squared	Coefficient	Std. Error	t-Stat	Statistical Significance
net rents RV	net rents VADD(1)	0.7013	1.2555	0.2591	4.8499	**** (99 %)
net rents RV	net rents VADD(2)	0.8194	1.2389	0.1839	6.7358	**** (99 %)
pulp rent RV	pulp rent VADD(1)	0.1267	0.4939	0.4100	1.2047	
pulp rent RV	pulp rent VADD(2)	0.3176	0.6751	0.3129	2.1574	* (90 %)
wood rent RV	wood rent VADD(1)	0.0283	0.2219	0.4100	0.5398	
wood rent RV	wood rent VADD(2)	0.3110	0.8462	0.3983	2.1245	* (90 %)
sawmill rent RV	sawmill rent VADD(1)	0.0431	0.2669	0.3978	0.6709	
panelboard rent RV	plywood rent VADD(1)	0.0231	-0.2647	0.5440	0.4866	

(note: **** denotes statistical significance at the 99 per cent confidence interval; * is 90 per cent confidence interval).

The results are interesting because they indicate that while there is no significant relationship between residual valuation rents and value added rents in individual sectors (with the exception of pulp RV-pulp VADD(2) and wood RV-wood VADD(2)), there is, however, a significant relationship between total forest industry rents between residual valuation figures and both value added rent figures. The lack of statistically significant relationship between individual components of the forest industry could be due to the fact that value added figures do not net out indirect taxes whereas residual valuation figures do. The relationship between residual valuation results and valued added results for total forest industry rents is statistically significant at the 99 per cent confidence interval for both primary (VADD(1)) and primary plus secondary industries (VADD(2)). This would suggest that the results of both methods are highly correlated (high R-squares in both cases) and significant. What is particularly interesting is that residual value results are more highly correlated with value added results of both primary and secondary industries.

The results were then analyzed to determine whether a trend exists in the rent values imputing for both methods and whether it is statistically significant. Trend analysis is performed by regressing a trend variable (independent variable) or time on the imputed rents (dependent variable) for each forest product or sector. The OLS regression results are shown in the following table:

Table 4.23 Rent Trend OLS Regression Analysis Results

Rents	Coefficient	Std. Error	R-squared	t-Stat
Lumber RV	-0.9015	0.6573	0.1583	1.3715
Lumber VADD	0.7805	0.4969	0.1979	1.5709
Plywood RV	2.0797	1.7910	0.1188	1.1612
OSB RV	-5.3379	1.3910	0.5956	3.8375
Panelboard RV	-1.3697	1.5302	0.0742	0.8951
Plywood VADD	-0.0596	0.6597	0.0008	0.0904
Pulp and Paper RV	2.1190	1.2716	0.2173	1.6664
Pulp and Paper VADD(1)	-0.4781	1.9949	0.0226	0.4804
Paper and Allied VADD(2)	-0.0822	1.1826	0.0005	0.0695
Total Forest Industry RV	-0.1744	0.6914	0.0063	0.2523
Total Forest Industry VADD(1)	0.1847	0.3705	0.0242	0.4984
Total Forest Industry VADD(2)	-0.5883	0.4074	0.0898	1.4438

The results are inconclusive showing that, with the exception of oriented strandboard residual valuation rents, there is no statistically significant trend in forest rents in any forest industry or product line. We can only that the sign on the coefficient indicates the direction of the trend in rents. To this extent, we can say that there is no apparent trend in lumber rents as evidenced by the contradiction in signs on the RV and VADD coefficients. In plywood and panelboard products the results suggest declining rents over the study period in both cases. Trends in pulp and paper rents are also inconclusive. The same inconsistency is exhibited with respect to total forest industry rents. The results do however, show the extreme volatility in rents from one year to the next as reflected by large standard errors for the coefficients for all forest product rents.

Furthermore, sensitivity analysis was performed on the results including a measurement of the relationship of rents to forest product price indices. In this analysis we measure the elasticity of rents was measured with respect to changes in forest product price indices. The Canadian forest product price indices for lumber, plywood and veneer, wood industries, pulp and paper, paper and allied, and for the total forest industry were used as reported by Statistics Canada. The elasticities of rent are calculated using ordinary least squares, using a log-log functional form with rent as dependent variable and price index as independent variable. The coefficient on the independent variable using this function form is the elasticity of rents with respect to changes in the product price index. The results are shown in table 4.24 as follows:

Table 4.24 Elasticity of Forest Rents with Respect to Product Price Indices

Rents	Elasticities		
	Residual Valuation (RV)	Value Added (VADD(1))	Value Added (VADD(2)
total forest industry net economic rents	3.7938	4.7721	1.3181
wood industries	5.3154	4.5075	1.6653
pulp, paper and allied	1.9143	1.3309	1.5795
sawmills (lumber)	not applicable	8.2390	12.7511
plywood	not applicable	2.3258	6.7891
panelboard	3.0685	6.7891	not applicable

The elasticity results show the sensitivity of rents or the change in rents with respect to a change in price indices. The greater the elasticity figure the more sensitive rents are to changes in prices or the more inelastic rent is with respect to the price index for a given forest product. The results suggest that sawmill (lumber) rents are most sensitive to price changes whereas pulp and paper rents are least sensitive in the case of both residual valuation and value added rent figures.

Overall, forest industry rents are fairly sensitive to price changes except with respect to VADD(2) rents or rents for both primary and secondary forest manufacturing activity.

F. Estimated Rent Collections by Government

With estimates of Alberta forest rents and data on direct and indirect taxation of the sector it is now possible to determine the share of rents captured by the provincial, federal, and municipal governments through direct taxes (corporate income taxes) and indirect taxes, including stumpage and other forestry charges. Percy's (1986) estimates for British Columbia showed that the B.C. government collected roughly 67.4 per cent of logging industry rents and 41.2 per cent of total forest industry rents in 1979 using indirect taxes Our results, (see table 4.25) show forest rents collected by the Alberta government for the years 1979 to 1990. Residual valuation rents have been adjusted adding back indirect taxes which were previously netted out. Value added rent figures are as per previous tables.

The results show that for the years 1979 to 1990 the Alberta government captured, on average, between 29.2 per cent of the total forest rents (using residual valuation rents) and 37.5 per cent of rents from primary forest industry manufacturing activity through indirect taxes, such as stumpage pricing. (As noted, stumpage pricing should ultimately be viewed as the primary means or instrument available to the provincial government in collecting forest economic rents). In the case of VADD(2), or primary plus secondary forest product manufacturing rents, the government collected on average, 14.0 per cent of total forest rents. All figures are shown in constant 1986 dollars for means of comparison. The results do show that there is considerable variability in the share of rent captured by government given the extreme variability in forest rents themselves and given the relative consistency of administrative stumpage pricing and other forestry charges. This is true of both residual valuation and VADD(1) imputed rents but less so of VADD(2) imputed rents, which exhibit consistently low rent capture during the study period. In some years, particularly 1982, rent capture apparently exceeded rents generated by the industry

This analysis is not complete without considering the impact of other taxes, including

Table 4.25

Estimated Share of Rents Collected by the Alberta Government Through Indirect Taxes.

(values in constant 1986 dollars)

	Residual Valuation	Value Added Primary Wood Industries (VADD(1))	Value Added Total Wood Industries (VADD(2))
Total Forestry Rents Before Indirect Taxes (thousand constant dollars)			
1979	160,448	78,333	166,061
1980	72,906	19,589	124,110
1981	31,479	618	143,881
1982	(75,832)	(19,226)	42,776
1983	(15,025)	28,494	88,082
1984	29,648	66,387	132,353
1985	25,460	10,440	132,856
1986	72,355	34,600	139,800
1987	204,088	127,004	227,290
1988	172,714	180,710	263,785
1989	144,681	111,458	204,774
1990	8,089	8,074	67,536
Average	69,251	53,873	144,442
Indirect Taxes (thousand constant dollars)			
1979	11,665	11,665	11,665
1980	10,551	10,551	10,551
1981	11,072	11,072	11,072
1982	12,038	12,038	12,038
1983	16,677	16,677	16,677
1984	18,931	18,931	18,931
1985	17,809	17,809	17,809
1986	18,555	18,555	18,555
1987	36,983	36,983	36,983
1988	35,085	35,085	35,085
1989	28,850	28,850	28,850
1990	24,066	24,066	24,066
Average	20,190	20,190	20,190

Table 4.25 (continued)

Total Forestry Rents **Net of Indirect Taxes** (thousand constant dollars)	Residual Valuation	Value Added Primary Wood Industries (VADD(1))	Value Added Total Wood Industries (VADD(2))
1979	148,783	66,668	154,396
1980	62,355	9,038	113,559
1981	20,407	(10,454)	132,809
1982	(87,870)	(31,264)	30,738
1983	(31,702)	11,817	71,405
1984	10,717	47,456	113,422
1985	7,651	(7,369)	115,047
1986	53,800	16,045	121,245
1987	167,105	90,021	190,307
1988	137,629	145,625	228,700
1989	115,831	82,608	175,924
1990	(15,978)	(15,992)	43,470
Average	49,061	33,683	124,252
Estimated Percentage of Rents Collected by Government			
1979	7.3%	14.9%	7.0%
1980	14.5%	53.9%	8.5%
1981	35.2%	1791.6%	7.7%
1982	-15.9%	-62.6%	28.1%
1983	-111.0%	58.5%	18.9%
1984	63.9%	28.5%	14.3%
1985	69.9%	170.6%	13.4%
1986	25.6%	53.6%	13.3%
1987	18.1%	29.1%	16.3%
1988	20.3%	19.4%	13.3%
1989	19.9%	25.9%	14.1%
1990	297.5%	298.1%	35.6%
Average	29.2%	37.5%	14.0%

Notes: (1) All figures are in constant 1986 dollars.

(2) Residual Valuation rents are shown with total indirect taxes added back into the total forestry rent values.

(3) VADD(2) is value added approach rents for total forest industries, including secondary wood-using.

(4) Estimated percentage of rents collected by the Alberta government is based on the ratio of indirect taxes (which includes stumpage and other forestry charges) to forestry rents before indirect taxes.

(5) Average percentage of rents collected equals average total rents divided by average collections.

(6) Indirect taxes included stumpage charges, lumber export tax, and other forestry related taxes and charges.

corporate income taxes, on the rents generated from total primary and secondary forest product production. As per table 3.1, which summarized estimates of indirect and direct taxes paid by the Alberta forest industry , the total Alberta forest industry paid an estimated average of $28.2 million (in constant 1986 dollars) per annum during the 1979-1990 period in corporate and municipal taxes. This would suggest that corporate income taxes, both federal and provincial, and municipal taxes combined captured more of the forest rent than did indirect taxes, such a stumpage fees. These direct taxes from the forest industry averaged $28.2 million (of which $8.7 million or 31 per cent was provincial corporate income tax) compared to $20.2 million in indirect taxes per annum (all in constant 1986 dollars).[61] This reveals that direct taxes captured roughly 40 percent of rents (net of indirect taxes) in the case of residual valuation imputed rents, 84 per cent of value added imputed rents for primary production, and 22.7 per cent for primary and secondary valued added rents. It should be cautioned however, that the corporate income tax figures are for both primary and secondary wood using manufacturing industries.

When the total of all indirect and direct taxation by all levels of governments (provincial, federal and municipal) are considered, an average 70 percent (residual valuation) to 90 per cent (value added) primary forest industry rents were collected. Of the combined primary and secondary forest industry rents (value added approach), 34 percent of available rents were captured by all levels of government. Again, it should be noted that taxation has increased rather substantially since 1987, due mainly to the imposition of the lumber export tax. Isolating only the Alberta government, rent collected through direct and indirect taxation amounted to an average $28.8 million per annum (70 per cent of which was through indirect taxes (stumpage, lumber export charges, and other forestry charges) and 30 per cent through provincial corporate income taxes) [62]over the study period, which translates to the collection of an estimated annual average of 41.6 (residual valuation approach) to 53.5 per cent (value added approach) of available forest rents from the primary forest industry.

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[61] Only more recently (since 1987) with the introduction of the lumber export tax, have indirect taxes begun to match direct tax revenues from the forestry sector in Alberta (see table 3.1)

[62] It should be noted again that since 1987, with the imposition of the lumber export tax, this breakdown between direct and indirect provincial taxes has changed. For example, in 1990 an estimated 81 per cent of forestry related taxes were through indirect taxes and the remainder through corporate income taxes.

G. Future Expected Rents

An examination of future expected rents in Alberta's forest industry is important in consideration of the transformation of the sector from a predominantly lumber-based industry to one which will become increasingly pulp and paper based. This trend towards greater pulp and paper production as new pulp and paper mills are developed is critical given the results of our rent imputations which show pulp and paper industries generate the vast majority of forestry rents.

Based on announced and expected forest industry development projects (see table 19.0,appendix) it is possible to project the rents that can be expected in the year 1998 when most of these projects are expected to reach completion and attain full productive capacity. Projections of rents are based on the assumption that the rents by industry or project will be similar to the average, constant dollar, figures imputed on a per cubic meter of wood input basis. Converting expected production in 1998 to a cubic meter of wood input basis, it is then possible to project rents in Alberta's forest industry by 1998 given that all other factors (including stumpage and other forestry charges) remain relatively the same. Of course, changes will likely occur including the increased costs of reforestation due to the new free to grow standards, however, despite these changes our results are meant only to be illustrative.

The results, shown in table 4.26, reveal that in the case of residual valuation rents, projected total forest industry rents by 1998 are expected to reach $249.9 million, with the pulp and paper industry accounting for slightly more than 90 per cent of this total. The value added approach rent projections show total forest industry rents (before indirect taxes) of $186.2 million, with the pulp and paper industry accounting for 87 per cent of the total. The value added estimates for both primary and secondary manufacturing project rents to be $429.9 million (before indirect taxes), with paper and allied industries accounting for 76 per cent of the total. These projections are meant only to illustrative the potential magnitude of forestry rents expected from Alberta's forest industry as it expands capacity during the current decade.

Table 4.26

Projected Future Forest Rents in Alberta (1998)

(in constant 1986 dollars)

Industry/Product Rents	Projected Production	Estimated Wood Inputs (cubic meters)	Estimated Rents (constant 1986 dollars)		
			Residual Valuation	Value Added (1) Primary Industry	Value Added (2) Primary + Secondary
Lumber	2,180,000 Mfbm	9,356,223	(10,853,219)	2,151,931	n.a.
Panelboard Plywood	243,700 Msf	363,731	(2,055,080)	**	n.a.
OSB	1,130,000 Msf	1,921,769	32,151,195	**	n.a.
MDF	50,000 Msf	225,000	3,341,250	**	n.a.
Total Panelboards		2,510,500	33,437,365	21,514,985	n.a.
Total Wood Industries		11,866,723	22,584,146	23,666,916	103,240,490
Pulp and Paper					
Softwood Bleached Kraft	796,000 AMDT	4,456,887	*	**	n.a.
Hardwood Bleached Kraft	1,397,000 ADMT	6,583,412	*	**	n.a.
CTMP	580,000 ADMT	1,566,298	*	**	n.a.
Newsprint	440,000 tonnes	1,188,226	*	**	n.a.
Total Pulp and Paper Industries		13,794,823	227,338,683	162,503,015	326,661,409
Total Forest Industries		25,661,546	249,922,829	186,169,931	429,901,899

Notes: n.a. – not applicable; * – included in total pulp and paper industry figure; ** – included in total panelboard rents or total pulp and paper industries.

(1) Production is estimated based on table 22 (appendix); (2) Rent values are estimated using the average per cubic meter rents imputed earlier for each respective product/industry using constant 1986 dollars; (3) Total forest industry rents for RV would include indirect taxes; VADD(1) and VADD(2) rents do not.

CHAPTER V

DISCUSSION

A. Summary and Discussion of Results

The results of rent imputation for Alberta's forest industry provide considerable material to assess the performance of timber pricing policies in Alberta and the their ability to appropriate forest rents to the provincial government. They have implications also for taxation policies in general, specifically the relationship of corporate income taxes, in collecting rents, *vis-a-vis* the role of stumpage fees and other indirect taxes. These issues and others are addressed in the following section.

The results suggest that between $53.9 million (value added approach) and $69.3 million (residual valuation approach) in forest rents were generated annually by primary wood using manufacturing industries in Alberta between 1979 and 1990 (in constant 1986 dollars and before indirect taxes). The value added results also reveal that for the total forest industry, including primary and secondary manufacturing, an average $144.4 million in rents per annum were generated during this period (also in constant dollars). The total forest industry rent figures calculated using residual valuation and value added were shown to be statistically highly correlated. The pulp and paper industry constituted the majority of forest rent generation accounting for between 68 percent (value added) and 117 per cent (residual valuation) of total forest industry economic rents. In contrast, the lumber industry accounted for an annual average of 62.2 per cent of total wood harvested yet generated only between 15 percent (in the case of valued added) and negative 23 percent (in the case of residual valuation) of total forest industry rents (note: the pulp and paper industry consumed an estimated average of 29.3 percent of total wood harvested).

While total industry rents are correlated, the only statistically significant correlation between respective forest industry subsectors or product rents was for pulp residual valuation (RV) rents and VADD(2) (value added rents for the total paper and allied industries). The other significant relationship is between total wood industry RV rents and wood industry VADD(2) or value added rents for total primary and secondary wood industries. We can only speculate as to the reason that rents calculated for the aggregate industry, using both methods, are more highly correlated than the correlation between individual subsectors or product categories. It may relate to problems with the value added data itself or in the fact that indirect tax data could not be pulled out of the residual valuation figures. As noted earlier, we have more confidence in aggregate value added data for wood and paper and allied industries than for disaggregated sector data because the aggregate data was consistently reported whereas industry specific data was only sporadically reported by Statistics Canada.

The results also suggest no apparent trend in rents in either individual product or industry rents or for the entire Alberta forest industry. This suggests considerable volatility in forest rents in contrast to a consistent upward trend in forest product price indices. Our results underscore the sensitivity of rents to variable costs of production, more so than any other factor including price. Costs tend to exhibit consistent increases over time whereas prices can fluctuate considerably, though there is a positive, upward trend.

The rent imputations suggest that the Alberta government captured an average of 29 to 37 percent of total available primary forest industry rents (based on the residual valuation and value added rent imputations for primary forest industries respectively) through indirect taxes (stumpage fees, lumber export taxes, and other forestry charges). Taking primary and secondary forest industries together, suggest the Alberta government captured an average 14 per cent of available rents over the study period through these indirect taxes.

When considering direct taxes, such as provincial corporate income taxes and municipal taxes, in addition to indirect taxes (example, stumpage charges), it is estimated that the Alberta government captured between 43.8 per cent (residual valuation) and 56.3 per cent (for value added- primary), of available primary forest industry rents generated between 1979 and 1990 (in constant dollars). Considering both rents generated by the combined primary and secondary

[63]forest manufacturing industries, the Alberta government collected an estimated 21.0 per cent of available rents through direct and indirect taxation. The federal government also captured a portion of Alberta forest rents through corporate income taxation, which amounted to between 26.1 percent (residual valuation) and 33.5 percent (valued added - primary) of available rents. What is important is that the Alberta government could have, in essence, retained the majority of the federal government's share of forest rents through more stringent indirect taxation. Ironically, while the lumber export tax has been a burden on industry, the provincial government's share of rents has increased because of the tax.

Projections for 1998 reveal considerable rents will be generated, primarily in the pulp and paper industry, assuming that the average, constant dollar rent figures can be applied to future periods. Nevertheless, rents could range from between $186.2 million and $249.9 million from primary forest industry production and close to $430 million for primary and secondary production. This of course assumes that costs will be similar in constant terms in 1998 as they are in 1986 dollar terms.

B. Were Past Rent Collections Sufficient?

There is no clear or simple answer to the question of whether or not timber resources were underpriced and whether rent collection was sufficient; it depends on the perspective we take. This is as much a political problem as it is economic (Percy and Yoder, 1987). Our results are important in any discussion of current and future rent collection and resource pricing policies adopted by provincial governments.

As Percy and Yoder (1987) note, "the correct approach to determine whether underpricing exists would be to compare stumpage values administratively set with those obtained in a competitive bidding market (p. 59)." Any discrepancies between the price of timber received in competitive log markets compared to the prices set administratively would reveal the extent to which government is realizing full stumpage value. However, in the absence of a competitive log or timber markets in Alberta , such an experiment is not possible.[64]

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[63] Secondary forest product manufacturing industries refers to forest product production that has value-added to the primary production of lumber, pulp and paper, and panelboards. Examples of secondary industries include, cabinet and furniture, door and window frame, and wooden pallet manufacturers.

First, our results suggest that when stumpage fees and other forestry charges (that is, indirect taxes) are considered alone, as the primary means of forest rent collection, the Alberta government captured an estimated average of 29.2 to 37.5 per cent (per annum) of primary wood industry rents available during the period 1979-1990. The evidence suggests that, for the entire forest industry, only 14.0 per cent of both primary and secondary industry rents were captured. In comparison, the study by Percy (1986) estimated that the B.C. government collected 41.0 per cent of available rents generated by primary and secondary forest industries in 1979 (our estimate for Alberta in 1979 shows 7.0 per cent of rents were captured by the Alberta government). While the differences are considerable there are no clear conclusions that can be made. The fact that far less rent was captured from secondary producers could be due to secondary manufacturers benefiting from non-arms-length transfers of low costs wood inputs from the primary producers. There is, however, no evidence to support or refute this hypothesis.

Percy (1986) cautioned putting too much emphasis on the success of rent collection through indirect taxes (stumpage and forestry charges) since, in the absence of competitive bidding, they are, inherently, crude means of collecting rents and "will always fail to capture a significant proportion of rents" (Percy, 1986, p.39). In the B.C. case, he suggested that, because the rents imputed contained returns to land held in fee simple (that is, rent collected from private forest land) and quasi-rents, the B.C. government may have in fact been quite successful in capturing an adequate share of rents.

Second, depending on how we view the role of direct taxes (corporate income taxes and municipal taxes) we could argue that, in combination with indirect taxes (stumpage fees), the provincial government fairly was successful in collecting available forest rents. Our results show that an estimated 70 percent (residual valuation) to 90 percent (value added) of forestry rents from the primary wood using industries were collected through the full tax spectrum of stumpage fees (and other forestry charges), lumber export tax, corporate income taxes (both federal and provincial) and municipal taxes. The question is, however, whether using such a broad spectrum of rent collection mechanisms is appropriate or whether resource rents should in fact be shared by all levels of government, as they currently are. There are problems with assuming that direct taxes have a role to play in resource rent collection or ultimately resource pricing because, if used in this capacity, they introduce their own distortions. For example, to the extent that corporate income taxes capture a significant portion of the forest rents may suggest that timber has been underpriced through the stumpage pricing mechanism. Second, income taxes have a tendency to drive a wedge between marginal costs of production and product price thus creating distortions to the producer's economic behavior. [65]

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[64] It should be noted that such an experiment is now possible (to some degree) in British Columbia, with the introduction of the B.C. Small Business Program which involves competitive bidding for timber, thus introducing a log market, and thus providing some indication to the provincial government about whether or not their own stumpage pricing (revenue targeting) system is collecting a reasonable share of rents.

The results reveal considerable variance in rents by individual forest industry or product. For example, rent capture in the lumber or sawmill industry may have been more than sufficient or, in some years, excessive in capturing rents. In the case of the lumber industry, the negative rents (residual valuation approach) generated in six out of twelve years should be cause for concern, since it may suggest an industry that has generated marginal returns on investment in public timber resources. In contrast to the lumber industry, the Alberta pulp and paper industry has generated significant positive rents and with apparently less than adequate share of rents being captured by the Alberta government. For example, average rents (residual valuation approach) in constant dollars were $16.48 per cubic meter of wood input , that is with stumpage and other charges netted out. If we assume an average stumpage rate of $1.75 per cubic meters, (in constant dollars), this would suggest that an estimated 9.5 per cent share of available rents were captured by the Alberta government through stumpage and other charges. It is also evident that rents in panelboard industries are significant, particularly in the OSB/Waferboard and MDF industries, who utilize deciduous, aspen wood stock and other wood residue. This is shown most clearly in the residual valuation results. These same results suggest however, that rents in plywood industries have been largely negative. Overall, the results seem to suggest a positive correlation between value added forest product manufacturing and rent generation, an hypothesis worth pursuing in future research.

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[65] Personal communication with Dr. Michael Percy, Acting Chair, Department of Economics, University of Alberta, June 6, 1991.

There are other considerations in this discussion, including the capture of rents through government forest management and environmental policies and regulations that are used , amongst other objectives, in the interest of ensuring that non-timber resources are managed in society's best interest. These factors have been considered by some authors (Haley and Luckert, 1990) to be critical in a discussion of stumpage policies and forest tenures. However, the impact and relationship of these factors to forest rents has not, to date, been empirically evaluated and is thus worthy of further research. It must suffice to only mention these as caveats to the results.

It would seem reasonable to conclude that the Alberta government failed to exercise the full extent of it's rent collection capabilities through resource pricing mechanisms alone, specifically stumpage pricing. Nevertheless, the sum combination of both indirect and direct taxes, applied by all levels of government, did capture a significant portion of forest rents available. The question is whether or not the mix of resource rent collection taxes was or is appropriate and whether or not the federal and municipal governments should share in these rents. We could argue that more emphasis could be placed on improving the resource rent collection abilities of stumpage pricing, alleviating some of the complexities and distortional tendencies of current tax policies. As to who should capture these available rents will continue to be debatable. Ultimately, as Cairns (1982) suggests, "we have no social philosophy for deciding who should get economic rent, except for John Stuart Mill's dictum that it should be gained by society as a whole" (p.280).

C. Does Failure of Governments to Collect Rent Constitute a Subsidy?

The issue of whether underpricing a public resource constitutes a subsidy to the industry is one of the most controversial and long-standing debates in the forestry sector. It has come to the forefront of debate as a result of the lumber trade dispute between Canada and the U.S. and the Canada/U.S. Free Trade Agreement discussions about the definition of a subsidy. There are no easy answer to what constitutes a subsidy and whether it results in injury to any one party. There are tremendous misconceptions over the issue, misconceptions which can be cleared, to some degree, through a discussion of what economic theory would say about the issue. The issue of subsidies and stumpage underpricing tends to be related more to how stumpage fees are levied and collected as to how much is collected by governments (Percy and Yoder, 1987).

Economic theory says that, in the static case or short run, less than full rent collection through maximum stumpage pricing by governments will not induce firms to increase their level of output, thus act as a subsidy. The real question is would firms act any differently by increasing output, in the short term, if timber were allocated to them free of charge than if they were charged the full stumpage price? The simple answer to this is that firms, in the short term, static case, would not increase or alter production if the timber were given to them free of charge. This is because firms, operating at the margin, would continue to equate their marginal costs with marginal revenues of production Thus, even if the timber were free of charge, the firm would still want to produce at the margin.

Failure to collect the full economic rent cannot increase the supply or output of wood products. This is because stumpage is, by definition, economic or resource rent. Whether the firm retains the rent in the form of profits or governments captures a share, will not induce the firm to alter it's production; again, at least in the short term. If governments were not collecting the full available rent, the firm would simply earn higher profit margins (Percy 1986). Only if the Crown does not collect all of the economic land rent from the firm, and if rent is not capitalized into the equity value of the firm, and if capital markets are imperfect, could there be any impact on production or prices. Only if these three conditions existed, simultaneously, could the firm have cash flows which could become a lower-cost source of finance than capital markets. Furthermore, firms are restricted through government utilization standards and sustained yield policies to conform to a given level of wood input, thus further limiting their ability to alter production levels in the short term.

However, in the dynamic sense or long term, underpricing resources may introduce some distortions to the manner in which resources are allocated, utilized, and managed. Firms may be induced by governments, through economic development incentives (which may include favorable resource pricing), to exhibit rent seeking behavior by rushing into developments to secure future rent flows. Southey (1978) suggests that when governments encourage rapid land development (for example, homesteading and forestry development) using public natural resources, under the auspices of economic development and job creation policies, without regard for the full economic value or rent of these resources, then rent dissipation can occur. He suggests that this has occurred in the case of the forest, minerals, and petroleum and coal industries in Canada. Percy and Yoder (1987) also support the possibility that rents captured by the industry could be dissipated in the form of excess capacity "built to justify higher annual allowable cuts" (p.71). Under such a scenario, firms may enter into such development investments, even if profits are not anticipated in the short run in anticipation of future profits. That is not to say that the development of the resource would not have occurred sometime in the future. However, correctly valuing the timber resource (for example, through stumpage fees that reflect the full available rent) may have resulted in a less rapid development of Alberta's forest industry. This rent seeking behavior of firms investing in Alberta is only an hypothesis but is of considerable value for future research.

On the other hand, Gunton and Richards (1987) have argued that failure of government to collect full rents can act as a subsidy which distorts prices and thus a firms production decision allowing for what they calls 'X-inefficiencies' or allocative efficiencies, at least in the long term. This could lead to an inappropriate industrial development strategy as well as inappropriate resource allocation and the emergence of a high cost industrial structure in the long term. Inefficiencies may arise because firms are allowed to earn and retain normal profits without regard to the true costs of production (value of wood inputs) and forest management. Pearse and Dasgupta (1974) and Peterson (1977) have also argued that, because it is impossible to define efficiency independent of equity, the allocation of income to different parties through rent dissipation could shift the demand for goods and their prices, and have an affect on efficient production levels. There is no evidence to support or refute this hypothesis.

Livernois (1990) [66] argues that because the Alberta and other Canadian forest industry competes and trades in an international market, it does not matter whether governments choose to provide a wealth transfer to these firms, through, for example, low stumpage rates. What is important is whether firms are provided incentives to increase production for exports. Livernois suggests that the rent subsidy issue should be dealt with separate from the trade-effects of rent subsidies.

Finally, we should not lose sight of the importance of the resource pricing or rent collection mechanisms itself. According to Livernois (1990) a subsidy, in the form of allocation rights below their full value, does not in itself have an output effect nor does it change the production behavior of a firm so long as the rent collection device itself is non-distortional. What is critical, is the potential output effects, (at the extensive margin, and price distortions that may result from distortional rent collection systems. We know from the previous discussion that the current rent collection system is, inherently, distortional. We, for example, because rent is collected (via a royalty-based stumpage charge) from timber harvested at the extensive margin, firms would tend to harvest less timber and producer less forest product than they ideally would and currently do, excepting that utilization standards and sustained yield obligations constrain them.

D. Where do Uncollected Rents Accrue?

There has been considerable debate in the economics literature as to where uncollected resource rents accrue, whether they are dissipated by industry or government, or how they are realized by firms or governments. There have been several suggestions as to where rents uncollected rents are accruing including, through unionized labour markets (in the form of high wage rates), through capital markets (in the form of high profit margins), and through indirect capture by governments by socially beneficial constraints and regulations on industry (in the form of environmental and forest management regulations). Ultimately, there are three major interest groups in the forestry sector that participate in bargaining over rent distribution, in other words, rent seeking behavior (Schwindt, 1987).

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[66] Personal communication with Dr. John Livernois, Economics Professor, Department of Economics, University of Alberta, December 5, 1990.

Percy (1986) and Copithorne (1979) found evidence, in the case of B.C., that some forest rents were accruing to unionized labour, in the form of inflated or higher than average manufacturing industry wages in the forestry sector. While this situation for Alberta has never been studied, it is unlikely to exist, because of a less powerful unionized labour force and lower wage rates in the industry.

Other recipients of rents may be the forest industry through enhanced financial performance, excess profit margins, or the dissipation of rents through a flawed production strategy as a result of low wood input or stumpage costs. Past evidence of the financial performance of the Canadian forest industry suggests poor profit margins thus muting the claims that firms are earning windfall profits as a result of low stumpage pricing by provincial governments(Pearse, 1976). Schwindt (1987) presents another interesting possibility that rent dissipation may be occurring as a result of underpricing stumpage through a flawed industry strategy whereby the wrong product mix is produced or products are simply produced inefficiently. Both the 1976 B.C. Royal Commission on Forest Resources and Rumelt (1974) (in an analysis of the U.S. forest industry strategy and structure) argued that forest companies in North America have adopted a flawed low-cost production strategy (produced low value added products such as lumber, pulp and newsprint) that is partly a result of underpricing stumpage. Rumelt argued that the forest industry, in the U.S. has emphasized efficient operation of complex and capital intensive facilities and do too little consumer market development, research and new product innovation. As already noted, rents may be dissipated by industry through "X-inefficiencies" in the form of excess capacity.

Schwindt (1987) argued that the provincial government may indirectly capture resource rents by imposing "socially beneficial constraints on the operation of the sector "(p. 201). Luckert and Haley (1990) also support the idea that government imposed forest management regulations impose hidden costs on industry that in themselves capture a portion of rents. It is hypothesized that forgone stumpage or forest rents are captured indirectly through provincial forest management policies and regulations, non-timber resource management objectives, employment and community development policies, and investment and industrial development objectives. However, as Schwindt (1987) suggests, an evaluation of any such evidence may be beyond our current capabilities. It is certainly one of the more interesting areas for forest economics research.

Some rents will be captured through corporate income taxes, as already discussed. Coptithorne (1979) suggested that windfall rents that stay in the region they were generated may either be captured by governments through income taxation[67], by wages, and some in the form of profits to locally owned companies like suppliers of materials and equipment. The significance of the magnitude of rent capture through corporate income taxes vis-a-vis stumpage charges may indicate that these collections may have ironically been more important and successful in capturing forest rents than stumpage and other forest charges (as Boulter (1987) suggested). Any remaining rents, net of these direct taxes, should be found in the retained earnings of firms, since our calculations already include payments to holders of equity in the firm. The use of corporate income taxes in the collection of rents is in itself distortional since, they tend to drive a wedge between the marginal costs and production and the price of forest products. Furthermore, the fact that the federal government (and municipal governments through property taxes) shares in the provincial forest resource rents through it's share of corporate income taxes is interesting since ultimately, stumpage fees and other indirect taxes could be designed to appropriate the maximum available rent with little residual left for income taxation. In addition, since stumpage and forestry charges are deductible against taxable income under tax policy, it possible for provincial governments to collect the full share of forest rents through stumpage charges and other indirect taxes. This raises interesting political, constitutional, tax policy, and regional income distribution issues. It raises the question of whether or not the Alberta government has sufficiently exercised it's full extent of property rights over a publicly owned provincial natural resource or whether it should share these rents with other levels of government.

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[67] This was certainly evidenced in this study.

E. Do Rents Leak Into Capital Markets?

While the issue of rent dissipation by industry has been introduced, an expanded commentary is necessary. As hypothesized, uncollected rents, in the form of windfall profits, may leak into capital markets. If a firm is expecting to earn an annual resource rent it will tend to be capitalized into the equity value of the firm and thus to shareholders in the price of their shares (Copithorne 1979). This would occur only under conditions of a perfect capital market. Rents could also be retained in the retained earnings of a firm. A key point, however, is that to the individual firm it makes no difference whether the rents available to it are paid to shareholders, in the form of dividends of the government, in stumpage fees.

The analyses supports earlier work that refuted the notion of rents being dissipated in the form of windfall profits by forestry firms in Canada. Our estimates of returns on equity in the Canadian forest industry suggest that they were roughly three per cent poorer from 1979 to 1990 than the average rates of return on the Toronto Stock Exchange TSE300. In fact, our analysis suggests that rates of return on forest industry equity was even less than the 10 year Canadian government bond rate Percy (1986) also found that returns to forestry firms have been moderate to poor compared to other industries which suggests that few excess rents were available for leakage into capital markets.

Copithorne (1979) concluded that some windfall rents were captured outside of the economic region of B.C. by foreign multi-national corporations who may claim these in the form of dividends that exceed international rates of return to capital or may be reinvested in the region. It would be useful to complete such an analysis for Alberta where the majority of existing and new pulp and paper firms are foreign-based, multi-national, and horizontally and vertically integrated. Such an analysis could be an onerous, if not impossible, task.

F. Forest Rents and Silvicultural Investments

If investments in new forests or timber growing stock are not treated in the same way as investments in other capital in the determination of forest rents, there is a potential distortion to a firm's investment decision-making and to how it will view reforestation itself. Firms can only be expected to consider investments in new forest capital favorably if, they expect to earn future rents from future capital liquidation. To the extent that firms are expected or required to invest in future timber supplies by incurring the costs of reforestation today without any security or guarantee to access this same supply when it matures complicates this matter considerably .

This leads to a discussion of forest tenures and the relationship to rent. It is worth noting, that failure of governments to consider the costs of future timber capital investments properly in their imputation of forest rents and stumpage charges will ultimately distort the firms production and investment decisions serving as a potential disincentive to reforestation. Thus, forest management and reforestation regulations and standards alone, even if strictly enforced, cannot be expected to be carried out by firms who otherwise might consider such investments in capital as insufficient.

Another important consideration in a discussion of silvicultural investments and forest rents is the cost, to firms, of more stringent reforestation regulations, such as the recently introduced free to grow standard in Alberta and British Columbia. It is likely that firms will be faced with increasingly more stringent standards and will be required to absorb these costs despite little guarantee that they will reap their benefits in the next cutting cycle. Because these regulations can add to the costs of forest product manufacturing they must be considered as critical in a discussion of current and future stumpage and rent collection policies. Should these new standards translate to a $2.00 to $4.00 per cubic meter of wood harvest premium (in addition to the current estimated average $2.30 per cubic meter reforestation cost) we can see from our rent imputations that some producers, especially lumber manufacturers, might be faced with serious financial constraints, at least in the near-term. Recall that our estimates of net economic rents (that is, rents that were available but uncollected by government) from the primary forest industry ranged, on average, between $2.64 to $4.16 per cubic meter of wood input, in constant 1986 dollars. Added to this the increasing costs of environmental standards faced by the pulp and paper industry may translate into higher costs and fewer rents, at least in the near-term.

G. Rents and Forest Tenures and Regulations

Government regulations, forest tenures, and forest management policies may have an impact on forest rents, as has been suggested by Haley and Luckert (1990). These authors found that in a survey of forest companies in B.C. the industry considered forest tenure security and the taxation of economic rent as the two most important issues facing the industry. When governments collect economic rent in the form of stumpage fees and other taxes they also collect "social rents" in various ways. These include restricting behavior of forestry firms through regulations on volumes of harvest, utilization standards, and forest management policies. Luckert (1989) suggests that some rent is embodied in these regulations and tenure arrangements, and that these regulations have costs associated with them, which are not explicitly taken into account when stumpage is appraised or priced by the B.C. government. However, we suggest that while these constraints impose costs they should nevertheless show up in the costs of production of firms upon which the rent appraisal should be based.

Haley and Luckert (1990) noted that tenures have to allow for sufficient rent capture by firms to recoup capital expenditures and generate a fair return on silvicultural investments otherwise, investment will not occur. This, they suggest, is one of the main problems with current tenures. This may imply, supporting Clawson's claims, that problems in the industry will develop if current tenures and stumpage policies are based on rents from old growth timber capital stock without taking into consideration timber as capital and the unique characteristics of investing in such capital. Furthermore, Haley and Luckert found that, in B.C, there are little or no returns to equity from silviculture investments.

Nautiyal and Rawat (1987) found that while tenure security is critical to encouraging forest management investments, a reduction in the overall tax rate would also create a strong incentive to encourage firms to invest. They also found that taxation impacts on the optimal intensity of forest management.[68] Thus, the taxation of rents and tenure systems are inextricably linked.

H. Rent Leakage and the Exchange Values for Harvesting Rights

Uncollected rents may also show up in the exchange values of harvesting rights as suggested by Schwindt (1987,p.197). Ian McAskill (1982) estimated the value of MacMillan Bloedel's cutting rights in B.C. and found that they were appearing in the exchange value of harvesting rights granted by the Crown and that stumpage-bearing timber commanded substantial market values. This would suggest that some form of rent dissipation or leakage was occurring and that stumpage rates did not exhaust the full economic rent. The study of rent seeking behavior by forestry companies vying for the rights to stumpage may provide some indication that stakes are high enough to warrant such behavior.[69] Evidence of such behavior may be examined by assessing the relative bid prices for quota tenure sales in Alberta or by studying investment and entry activity and behavior of firms attempting to capture rents.

I. Forest Rents and Optimum Forest Rotation and Harvest Levels

Sandhu and Phillips (1989) and Nautiyal and Fowler (1980) have studied the impact of imperfect stumpage markets on optimum rotation and concluded that optimum rotation periods decrease as the real price of stumpage grows exponentially. They also showed that if there is a shift in the demand function for stumpage then this will affect the rotation. That is, if demand for stumpage increases in a subsequent period, during that rotation period, then optimum rotation becomes longer. Samuelson (1976) noted, in his analysis of optimal rotations, that if the growth of the forest in size and value is not taxed as true income and tax is deferred until the time of harvest, a "tax loophole" may be created which can distort decisions towards a longer rotation period.

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[68] They suggest that the most effective tax mechanism to apply to forestry production is a flat tax based on an appraisal of the after-tax profits or conversion surplus with an allowance for depreciation. Such a tax would not affect the silviculture and forest management decisions of firms.

[69] The subject of rent seeking behavior is a relative new one in the economics literature and has, as such, received very little empirical study, especially related to forestry. It does provide fruitful grounds for future forest economics research.

Setting stumpage prices above or below the actual available economic rent may also distort harvest practices. Setting them above the actual rent would discourage firms from harvesting the Annual Allowable Cut (AAC) while setting prices below the competitive level may encourage firms to harvest above the AAC level. We also know that charging stumpage fees for timber at the extensive margin (zero-rent land or resources) would cause output effects at the extensive margin causing total harvest to be lower than it otherwise would be. As already noted, stumpage systems in B.C and Alberta are distortional because they charge a minimum stumpage fee even for zero-rent or marginal timber.

J. Rent Capture vis-a-vis Economic Development Objectives.

It has been argued that rents could be dissipated through the pursuit of socially beneficial objectives of the government, including economic, employment, and community development It could be argued that the Alberta government has indeed, in the past three years, allowed rents to be dissipated by encouraging the full scale development of the forest industry through attractive stumpage prices. Clearly, the government has made no significant adjustments to stumpage pricing both preceding and during this unprecedented allocation of timber and industry development. Whether such a policy direction is good or bad is open to debate since it is as much a political question as it is an economic one. It does, however,raise the issue of how the government views less than maximum rent collection. While in the near-term it may have been part of the attraction for industry development, concern is raised that the government may be constrained, in the long-term, to collect more rents because of the contractual nature (with a negotiated base-rate stumpage price in Forest Management Agreements) of many of the tenure arrangements and because of administrative stumpage pricing policies themselves.

Our empirical evidence seems to suggest that in spite the Alberta government's focus on economic development, a large share of forest rents were, nevertheless, collected by all levels of government and through various tax instruments during the study period.

CHAPTER VI

POLICY IMPLICATIONS AND RECOMMENDATIONS

A. Policy Implications of Historical Forest Rent Collection

The results of this study of forest economic rents in Alberta have important implications for both current and future resource pricing and taxation policies. The analysis suggests that past and current resource pricing and rent collection policies have been distortional (because of their royalty-based tax characteristics), insensitive to market fluctuations, and have failed to collect the maximum available forest rents generated by the Alberta forest industry.

It could be argued that less than maximum forest rent collection by the Alberta government was evidence of a trade off in the interest of achieving other social objectives, including economic development, employment and community development, forest management policy objectives, and in consideration of managing non-timber resources (such as wildlife). As Cairns (1982) notes, " the purpose of resource taxation is not confined to rent collection and distribution alone, but also encompasses aspects of natural resource management" (p. 280). One could speculate that less aggressive rent collection by the government has allowed Alberta firms to record successful reforestation and forest management practices, with enough discretionary income to meet reforestation and forest management obligations. There is, however, no evidence to support or refute these suggestions that some rents were used in this manner.

B. Policy Options for Future Forest Rent Collection

This study suggests sufficient reasons to consider changes to the current timber pricing and forest rent collection regime. There are many options available to accomplish a change or movement towards a resource pricing regime that could be made both more sensitive to industry and market fluctuations, more equitable across the industry, and maximize rent collection to the provincial government.

Any changes to timber pricing or forest rent collection policies of the Alberta government must consider very carefully the sensitivity of firms to rent collection itself and to an increasingly dynamic market and operating environment, which includes increasing timber and non-timber management expectations and obligations. With more stringent reforestation standards, forest management, and environmental regulations being place on forestry operations, it is conceivable that based on past rents, the current levels of stumpage fees may not be entirely inappropriate. It would seem that it will become increasingly difficult to design rent collection systems that can explicitly account for the benefits and costs of these broader social objectives.. A clear understanding of the true value or rent generated by forestry activity should, however, be accompanied by an important shift in considering forests and timber as capital assets. Without a proper accounting of timber capital stock values, any future rent capture or stumpage pricing policies should be questioned.

Concern is raised as to the ability of firms to meet their current and future obligations for forest management and reforestation, since the imputed rents suggest that some producers, particularly lumber manufactures, may be generating negative rents on a fairly consistent basis. This raises some concern over forest investment and development strategies, the forest product mix, and the long-term resiliency of the sector. In light of the evidence, it would seem reasonable to adopt forest industry development strategies that encourages those industries and products which will generate maximum rents from investments in a public timber resource.

There is also some concern raised as to the ability of the government to alter stumpage pricing policies, especially with respect to the larger tenures, such as Forest Management Agreements. Because such contractual agreements contain negotiated stumpage rates , the government could be constrained, at least in the near-term, in revising these rates, even if it wanted to pursue greater rent capture. Furthermore, FMAs are becoming more common place and the forest industry development is based largely on pulp and paper industry development. As evidenced, the pulp and paper industry has historically accounted for almost 90 per cent of total primary forest industry rents which will only likely increase as new capacity comes on stream.

C. Appropriate Rent Collection Mechanisms

If the rent collection system could be restructured,which rent collection mechanism or system would best ensure maximum rent share for the provincial government and yet be neutral to the required investment returns of firms? What exists in Alberta, and most other Canadian provinces, is an extremely complex and cumbersome tax system attempting to appropriate rents for specific forestry related objectives, through a number of different and specific forestry charges, through) indirect royalty-type, stumpage charges or taxes, and through direct taxation, through corporate income taxes. Boulter (1987) suggests that what has resulted is several taxes and levies all taking small bites out the total available rent, all with their own associated distortional tendencies.

There appears, however, to be no single non-distortional taxation device available to governments for collecting the full economic rent generated by the production of forest products. Livernois (1990) noted that most resource rent taxes used by governments are distortional. Nonetheless, some taxation instruments are less distortional than others. Governments have tended to choose from a variety of *ex ante* and *ex post* rent collection systems in combination with forest resource policies, standards and regulations to appropriate resource rents. The use of the variety of tax devices currently applied is likely predicated on the fact that markets for stumpage are imperfect, costs of capital are largely unobservable, and conducting accurate appraisals of resource rent is difficult.

What kind of resource tax regime is available to forestry which are non-distortional? Livernois (1990) suggested that, under conditions of unobservable costs, there is no single optimal non-distortional tax instrument, rather, there may be a second-best tax instrument that, while being distortional, comes close to being neutral and optimal in rent collection. He suggests that such a tax instrument is considerably different than those used in practice. Livernois developed a theoretical, second-best tax regime in which a marginal tax rate would be applied, being a non-linear function of the rate of output, whereby lowest costs producers would face with a marginal tax rate of zero and highest costs producers face the highest marginal tax rate. Livernois concluded that, because most existing tax systems tend to work in an opposite fashion, with the lowest cost firm usually facing the highest marginal tax rate, present resource pricing taxation policies may not be efficient.

Given that the forestry sector is characterized by having unobservable costs of capital, what taxation devices can be used to collect rent while remaining relatively neutral? Livernois (1990), Percy (1986), Nautiyal (1980), Garnaut and Clunies-Ross (1974) and others have suggested that only lump-sum or cash-flow taxation devices have the best chance of taxing resource rents with the least distortional effects.

Percy (1986) suggested a lump-sum, cruise based stumpage system based on the appraised value of each respective forest area prior to harvest. A lump-sum charge would avoid some of the distortions of per unit stumpage fees. Under such a scenario, the stumpage paid is independent of the volume of timber actually harvested. This would allow the firm to utilize the extensive margin more profitably avoiding the shortcomings of current systems that tend to signal firms to high-grade. The major drawback to such a system is the administrative costs of cruising and appraisals.

Nautiyal (1980) advocates a fixed annual rent or flat tax on licensed land. The tax rate, revised annually or quarterly, could be based on imputed soil expectation values, the amount of wood cut in past years, or current timber growing stock. Rent or stumpage paid by the firm would be a fixed cost to the firm and would not distort their marginal costs and thus production decisions. He argued that rent collection using other per unit volume stumpage fee structures are simply futile in appropriating rent to the government since they distort the economic rent available. Such a system would also provide the correct signals for firms to invest in silviculture and other forest management. It would be simple to administer and would eliminate some of complexities of current stumpage fee structures. However, administrative costs can also be high and the calculation of soil expectation values may be impractical.

The resource rent tax (RRT) (developed by Garnaut and Clunies-Ross (1975)) could be applied to the forestry sector. It has features that are suitable to forestry and it's long-term capital investment periods and forest renewal investments. Because it is sensitive to profits and to the flow of returns on investment, this tax would avoid premature abandonment or discouragement of silvicultural investments. However, as noted earlier, the RRT also has distortional features due to the fact that economic costs of capital and the firm's investment discount rate are difficult to determine (Livernois 1990). A variation of the RRT (Boadway, Bruce and Mintx, 1982), is a rate-of-return tax which, instead of capturing a fraction of net present values, taxes the conversion surplus only when the internal rate of return of a project exceeds an allowable rate (Kemp 1987). Again, administrative costs tend to be high, because of the appraisal requirement, and defining an "allowable" rate of return is difficult. While such a tax has the advantage of being neutral and treating investments in capital equitably, large administrative costs may exceed these benefits Livernois (1990) suggested that the reason RRT-type taxes have not been more widely used is because it would require changes to current tax systems, systems so complex and entrenched that pursuing such tax reforms become nearly impossible.

A cash-flow tax, like the RRT is also non-distortional because it is structured with an accurate allowance for returns to capital. Livernois (1990) notes that because this tax allows for the full deduction of investment expenditures against income, it makes it unnecessary to measure the economic cost of capital. While simple to implement it has the disadvantage of having government share in potentially negative cash-flows and in risky investments. Thus governments might be reluctant to enter into such politically sensitive arrangements.

Some authors, including Livernois (1990) and Boulter (1987), have suggested that the best potential tax scheme for capturing rent is to use a combination of *ex ant* and *ex post* collection instruments. This would involve *ex ante* rent collection through auctions and bonus bids combined with either a cash flow or corporate income based tax. The B.C. Small Business Enterprise Program,adopted by British Columbia, represents such a system of stumpage pricing where stumpage prices are established through a competitive, quasi-stumpage market. This systems provides for a simulated stumpage market which government can observe and then more

more accurately determine appropriate stumpage price targets for other public timber allocations. Adopting such an option for Alberta seems remote under the existing tenure structure and because of the nature of the industry itself. Introducing a similar small business program would represent a departure from current allocation policies. While it could be argued that *ex ante* rent collection is available through the allocation of new and reissue of past timber quotas, the last round of timber quota renewals, that began in 1986, suggests that rent collection through such a regime will not be significant. Furthermore, the nature of FMAs, with their security and transfer provisions,and the lack of open competition for tenures will continue to limit the use of auctions in collecting rents.

D. A Two-Tier Resource Rent Tax System

Despite the absence of competitive stumpage markets, it would be possible to devise a forest rent collection system which accomplishes both maximum rent collection for the Alberta government and retains the neutrality characteristics desired by industry. Ideally, only one means of a rent collection should be sought that would appropriate all available rents to the province. However, since the current operating and tax environment is not ideal, and will likely remain so,a two tier rent collection mechanism is advocated. The first tier would be composed of a appraisal-type stumpage pricing structure, to capture the majority of rents, with a second tier, composed of a corporate income tax , to collect any residual rents that are not otherwise collected through stumpage pricing.

The first tier, stumpage pricing, would replace the current stumpage pricing structure and eliminate all other forestry charges. This stumpage pricing regime would use an appraisal approach whereby forest rents would be assessed on an annual or biannual basis for all major forestry products or forest industry sectors in the province. Rents would be those of an average efficient producer in each respective forest industry sector. Rents could be imputed in a similar fashion to the residual valuation approach through regular audits of forestry company operating and capital costs. Such audits would be completed in complete confidence, either by an independent auditor or accounting firm or by a government body. These rent imputations could be further evaluated or audited periodically by other quasi-judiciary bodies, including the Provincial Auditor General or the Natural Resources Conservation Board.

The second tier of this rent collection system would retain the current corporate income tax to capture any residual rents that remain after stumpage pricing. Such a system would essentially see less forest rents collected through corporate income taxes (not to mention municipal taxes) and more through the stumpage pricing mechanism. However, such a scenario may become problematic since, depending on how capital is treated in the first tier of rent imputations, it may require changes to capital asset depreciation, capital allowances and other related tax allowances under the existing corporate income tax system. The restructuring of the corporate tax system , in the interest of forest rent maximization for the Alberta government, may be an insurmountable goal and could receive some federal government resistance. If such changes resulted in a most-favoured tax status for forest industries, relative to other manufacturing industries, it may be viewed as inequitable and inefficient in the allocation of factors of production. Nevertheless, achieving such a system of rent collection is possible.

In terms of the rent imputations of the first tier, all major forestry firms, who have operations of a given scale, would be required to submit annual statements to the auditor. Information requirements could include a detail breakdown of income (product selling prices), variable costs of production (including all reforestation and forest management costs), and capital expenditures. An annual and average allowance for profit, risk, and depreciation or simply an opportunity cost of capital allowance could be imputed from the audited information, using a similar approach adopted in this study. As part of the audit, the firm would be required to provide a capital statement, showing changes in both operating and forest (timber) capital. All relevant information at the firm level would then be aggregated to determine a rent or cash flow statement for the average efficient producer in a given forest industry. A resource rent tax would then be levied on some portion of this average imputed rent with some allowances made for those firms which are less efficient or marginal producers. It would thus also allow the more efficient firms to retain rents that arose from efficiency gains through, for example, technological innovations.

In a sense, this approach approximates the cash flow tax structure discussed earlier. It could be administered along the lines of Livernois's (1990) second-best, marginal tax rate and would being both equitable and neutral in application. The most difficult decision would be choosing the resource rent tax rate applied to the imputed rent. Under such as system it would be possible for the provincial government to approach close to 100 per cent rent collection, if it desired to do so.

Such a rent collection approach would be neutral to firms because firms would only be assessed the timber resource rent tax after all costs applied in generating those rents were deducted. This would encourage firms to invest in both operating capital, new forest capital, and research and development, allowing firms to write these investments off as a cost component in the rent calculations. It would also eliminate the current cut-off grade problem associated with current stumpage charges. Such a system has the advantage of eliminate the complex array of other forestry related charges, thereby providing government administrative costs savings. These savings could then be reinvested in the audit services necessary to assess forest rents. It would also result in a reduction in the taxable income base available for federal and provincial corporate income taxes, thereby reducing the forest rents that currently flow to the federal government and municipal governments. This of course could be viewed as desirable or undesirable, depending on the perspective. This could only be accomplished, however, if the federal government corporate tax policy remained unchanged by continuing to treat stumpage payments as costs deductible against taxable income of the firm.

One potential drawback is the fluctuations in revenue streams to the provincial treasury that would likely result because rent flows would essential track market or forest product price fluctuations. While this is true, it is likely forest resource rent tax revenues will continue to be relatively insignificant, relative to other resource revenues (example, oil and gas royalties) to the provincial treasury. Another criticism is that, in essence, the industry becomes regulated by the government through such strict timber pricing policies. However, to the extent that we are dealing with public timber resources, such regulatory control over public resource pricing is no more unusual than the regulation of public utilities or other publicly owned resources.

Any tax regime or rent collection system must be sensitive to the smaller operators. While the average rent imputed for the industry should be applied to all producers to encourage efficiency of resource use, an tax levied should be sensitive to the specific operating circumstances and economies of scale the smaller operators face so as not to leave their operations unduly constrained. Given that it is the larger operators, the pulp and paper industry, that will continue to account for the majority of rent generation, it would easy to discount the smaller producer. However, the large number of smaller producers potentially have an important role to play in determining stumpage pricing plus they contribute to the resiliency of the whole forest sector.

The overall benefits of this rent collection regime would be greater resource rent capture to the provincial treasury and more accurate valuation of the timber resource to encourage wise resource allocation and investments in the future quality and quantity of the resource. Also, with a better understanding of the profitability of the industry, government policy makers would be better equipped to plan future developments knowing which investments in Alberta's timber resource will generate the greatest rents. Indeed, if government policy makers were more aware of the apparent negative rents in the lumber industry, it might consider carefully it's long term forest resource allocation plans, and instead focus it's attention on more lucrative rent generators, including the pulp and paper, panelboard producers, and secondary wood-using industries.

This scenario has the potential of encouraging firms to invest in new forest capital, including reforestation and stand tending (in spite of stringent regulations) and research and development. It would allow for the amortization of a broader range of investments by treating timber investments as any other capital asset. Compliance for payment could be ensured by having firms post a "rent performance bond" to guarantee that at least some revenues would be made available to the Crown in the event of financial failure or default.

CHAPTER VI

CONCLUSIONS

The issue of resource pricing or valuation, that is the determination of resource rents, is one of the most important forestry policy issues facing provincial governments in Canada. The determination of these rents and their collection through tax mechanisms is particularly important for resource-based economies, like Alberta's, who have traditionally relied on resource rent collection (most notably, oil and gas royalties) as a primary source of provincial government revenues. A discussion and analysis of resource rents generated from forest industry activity in Alberta is particularly timely in light of the unprecedented development of the industry that is just now evolving. Few studies exist on the subject of forest rents in Canada and it is hoped that this study will generate more interest in forest economic research and policy discussions.

Two major issues were examined with respect to forest economic rents in Alberta. The first was an examination of forest economic rents generated by the Alberta forest industry from 1979 to 1990. Rents were estimated for each sector of the primary wood using industries in Alberta using two approaches, a residual valuation approach and a value-added approach. The second issue examined was the success of rent collection by all levels of government through resource pricing and other taxation systems. Specifically, the historical success of the Alberta government in exercising property rights through the collection of economic rents from the forest resource base was examined. That is, how efficiently and equitably were forest rents administered and collected. Finally, forest economic rent collection and timber resource pricing policy options were examined, in light of a Canadian forestry sector increasingly reliant on second growth timber supplies and faced with increasing forest management obligations and costs.

The evidence of rent collection by governments suggests that the Alberta government has adopted an *ex post* rent collection policy using a combination of administered stumpage pricing (including other minor forestry charges) and corporate income taxes. Alberta has adopted a fairly simple administrative stumpage pricing system in which prices are administratively set by the government or , in the case of Forest Management Agreements, negotiated between the government and the company as part of a contractual agreement. From an economic theory perspective, such a timber pricing policy is inherently distortional and is relatively insensitive to forest product market fluctuations. The system of adminstratively setting stumpage prices has remained largely unchanged since 1975, when upset base stumpage prices were established. The main exception has been stumpage pricing under Forest Management Agreements, where stumpage prices are adjusted annually in relation to changes in the pulp price index. However, to the extent that the original negotiated base rate (established at the outset of each agreement) is itself not specifically based on an appraisal of timber value or rent and because stumpage prices are part of a contractual agreement could leave the provincial government little latitude or recourse in adjusting stumpage prices during the contract period (except for the pulp price index adjustments).

Alberta is one of the few provinces which has adopted an *ex ante* means of forest rent collection through competitive bidding for the sale of timber quotas when they are renewed every 20 years. However, revenues generated through these sales and the fact that many quotas are simply renewed, without intense open competition, suggests that *ex ante* rent collection has been minor. Only British Columbia's Small Business Enterpise Program comes close to a more comprehensive means of *ex ante* rent collection where, under a competitive stumpage bidding structure, stumpage prices are established.

The study used two methods for estimating forest economic rents in Alberta for the period 1979 to 1990. The residual valuation approach derives an economic surplus value or rent value, determined as the difference between the price of the forest product less the variable costs of production and an imputed opportunity cost of capital (which builds in an allowance for returns to capital investment (profit) and risk). The second approach, the value added approach, used Statistics Canada reported value added figures (that approximates the revenues less costs surplus figure of the residual value approach but requires the deduction of labour costs) to determine rents, by taking the difference of value added of manufacturing activity less labour costs and an opportunity cost of capital estimate (that includes an allowance for risk and returns to capital investments). Two approaches were used mainly to check the validity of one approach against the other and to add to the overall confidence in the rent imputations. We expected that the two analyses would yield similar results. Rents were determined both at the aggregate industry level and specifically for individual forest product or forest industry categories. This provided us a high degree of sensitivity to determine which forest industry sectors or products generated the greatest rent.

The empirical analysis revealed that between $53.9 million (value added method) and $69.3 million(residual valuation approach) (in constant 1986 dollars) in forest rents were generated per annum during the period 1979 to 1990 for the entire Alberta primary forest industries. The results show considerable variability exists in the rent generation capacity of individual forest product sectors or industries. The majority of forest rents were generated by the pulp and paper industry accounting for an annual average of between 68 per cent (value added method) and 117 per cent (residual valuation method) of total rents. In stark contrast, the lumber industry accounted for an annual average of only 15 percent (value added) and negative 23 percent (residual valuation) of total industry rents, while accounting for over 62 percent of the total timber harvested.

Rent projections were made for the year 1998, when it is expected that the Alberta forest industry will reach a maximum level of productive capacity. The results suggest that between $186 million (residual valuation) and $250 million (value added) in rents could be generated by the Alberta forest industry, based on historical rent generation.

An examination of the success of government(s), including provincial, federal and municipal, in collecting forest economic rents revealed that between 70 percent (residual valuation) and 90 percent (value added) of available rents from the primary forest products industry were collected, per annum, through numerous forms of taxation. The Alberta government,specifically collected between 41.6 percent (residual valuation) and 53.5 per cent (value added) of available rents, per annum, through stumpage fees, corporate income taxes, and other forestry charges. If we consider the application of only stumpage fees and other indirect taxes (including the lumber export tax and other forestry charges) by the Alberta government, between 29.2 percent (residual valuation) and 37.5 percent (valued added) of available rents were collected.

The results show that the estimation of rents is contingent upon the method adopted and that, there is no *a priori* information which suggests which method is the most appropriate. While we might of expected the two methods to yield similar results, the regression analysis shows no statistically significant correlation between the rents calculated using the residual valuation and value added methods, at least for individual forest product or industry subsector rents. What is of interest, however, is that when aggregated to the level of the total forest industry, the rents imputed by the two methods are statistically correlated. There is no clear explanation for this discrepancy except that it may relate to the inherent data constraints of both methods, that is, the lack of consistent and reliable Statistics Canada data for forest industry subsectors (used in the case of the valued added approach) and the lack of Alberta specific industry data (in the case of the residual valuation approach).

Regardless of the which approach may be deemed most appropriate, it is difficult to say with any certainty whether the Alberta government collected too much or too little rent. The results do, however, indicate that there has been insufficient flexibility in stumpage pricing. For example, during good market conditions, firms may be paying too little and during poor market conditions, too much. While historically there may have been good reason to adopt an administratively simple system of stumpage pricing, it has been at the expense of maximizing the full extent of forest rents being generated. Therefore, it can be argued that a timber pricing structure and taxation system more sensitive to market conditions would be more appropriate if the government wishes to exercise the full extent of its proprietary rights.

The study suggests that future resource rent collection and resource pricing policies need to be more sensitive to the dramatic changes in both market and operating conditions which the forest industry is facing. The analysis underscores the sensitivity of rent generation to changing forest product prices. With firms facing more stringent forest management obligations in Alberta, including the new free-to-grow standards and stand tending obligation, the government's resource pricing policies must be increasingly sensitive to these production cost realities. That is not to say, that the current stumpage pricing and forestry charges should remain unchanged.

Future resource pricing and rent collection policies for forestry should be designed to be a simple as possible, offering maximum efficiency for rent collection by the provincial government while being sensitive to the characteristics of Alberta's timber resources, market fluctuations, and changing resource management objectives. Resource pricing should be viewed as a means of encouraging optimum us of public timber resources. Given the current tenure structures, most notably the Forest Management Agreement, the government is constrained to pursue any form of *ex ante* rent collection through competitive bidding and auctions, because of the contractual nature of these agreements and because the original intent of such agreements was to provide increased security for firms. Nevertheless, an Alberta-made policy solution for resource pricing and rent collection is both desirable and possible.

The most appropriate resource pricing policy for Alberta timber appears to lie with and *ex post* rent collection system. Ideally, stumpage pricing should be the primary means of forest economic rent collection exercised by the Alberta government, in order to maintain simplicity, ensure equitable treatment of all firms, and yet meet the government's fiscal objectives of rent maximization. However, given the constraints of the current tax structure, a two-tier system is advocated, composed of stumpage pricing, using an appraisal or capital asset pricing approach to collect the majority of available rents, combined with corporate income taxation, to collect any residual rents that remain. This would see the elimination of the current stumpage pricing and forestry charges tax regime. Stumpage pricing would be based on an appraisal of resource rents by shadow pricing timber (similar to the residual valuation approach used in this study) and could be done by the government or through an independent auditor, reporting to the government[70]. Forest product prices, production costs, and capital cost data could be collected through audits of firms and industry subsectors, completed periodically (example, annually or biannually) in order to calculate resource rents. The imputed rent would in essence become either the base upon which a resource rent tax were levied or the pure resource rent tax itself (that is, if it appropriately accounted for allowances for returns to capital, profit and risk). The rent would be reflective of the average efficient producer and would be product or industry subsector specific. The actual rent tax levied could be adjusted or indexed, in accordance with unique market and operating conditions, and the respective economies of scale of less efficient producers.

The second tier of this system would see the retention of the current corporate income tax structure, whose role would be in the collection of any residual rents not already collected through stumpage pricing and the resource rent tax. Because forest resource rent tax would collect the majority of rents could dramatically reduce the share of rents currently collected through income taxes as well as reducing the share of rents captured by municipalities.

Such a timber pricing scheme would have several advantages including, the a more efficient and equitable forest rent collection system through the elimination of the complex array of other forestry charges (including the lumber export tax). This tax option would be neutral to firms because firms would be assessed a resource rent tax only after all costs of doing business have been deducted, including reforestation costs. It would be sensitive to the unique operating conditions of each respective forest products group. It should encourage investment in capital, reforestation, stand tending, and other non-timber forest resource management since such expenditures would be deductible against income and lower the resource rent tax base. It would eliminate the cut-off grade problems (at the extensive margin) associated with the current administered stumpage pricing regime. Knowledge of the rent earning capacity of forest product manufacturers would provide important information and report card to government on the returns on investment in allocated public timber resources. The success of such a forest rent collection system assumes, however, that corporate income taxation would continue to treat stumpage payments by firms as deductions against taxable income. Notwithstanding, such a tax scheme offers some promise for Alberta's forestry sector by removing the distortions of the current rent collection system, ensuring correct timber pricing, and ensuring that resource pricing is sensitive to a dynamic operating environment.

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[70] Alternatively, a capital asset pricing model could be adopted, similar to the Resource Rent Tax, in determining resource rents.

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APPENDIX

Table 1.0

Average Annual Inventories by Forest Industry
(million of current dollars)

Industry	Year	Total Wood Industries	Sawmills & Planning mills	Veneer & Plywood	Misc. Forest Products	Total Paper & Allied	Pulp & Paper mills	Total Forest Industries
Reported Inventories by Total Canadian Industry	1979	1030.0	823.4	93.6	239.2	1815.4	907.7	2845.3
	1980	1234.5	1021.8	106.2	257.7	2179.8	1089.9	3414.2
	1981	1240.0	993.1	116.8	282.0	2701.1	1350.5	3941.1
	1982	1161.0	902.5	118.7	282.0	3087.4	1543.7	4248.4
	1983	1437.0	925.0	100.0	267.8	3077.5	1536.0	4514.5
	1984	1577.5	1042.0	111.0	264.0	3447.2	1563.5	5024.7
	1985	1650.0	1104.0	104.0	276.5	3318.6	1609.0	4968.6
	1986	1806.0	1187.5	106.0	282.0	3465.7	1513.0	5271.7
	1987	2036.0	1333.0	120.0	330.0	2265.0	1589.0	4301.0
	1988	2216.5	1488.5	126.0	409.5	2422.0	1723.5	4638.5
	1989	2213.0	1416.0	124.0	449.0	2062.0	2013.0	4275.0
	1990	2291.0	1530.0	129.0	333.0	2861.0	2145.0	5152.0
Estimated Inventories for Alberta by Industry	1979	68.8	24.4	4.0	16.0	41.8	15.7	110.6
	1980	82.5	28.2	4.4	17.2	49.8	19.2	132.3
	1981	82.8	34.1	5.7	18.8	66.5	24.6	149.4
	1982	77.6	29.6	6.2	18.8	87.1	35.2	164.6
	1983	34.9	37.2	4.7	17.9	74.5	30.4	109.4
	1984	36.4	44.0	4.9	17.6	85.8	30.4	122.2
	1985	38.0	41.5	3.6	18.5	81.4	32.3	119.4
	1986	44.1	48.4	5.9	20.8	74.8	29.2	118.8
	1987	47.1	53.7	8.9	24.5	50.5	31.6	97.6
	1988	53.2	53.8	8.2	30.7	59.6	34.6	112.8
	1989	53.7	51.2	8.0	33.0	49.6	39.2	103.3
	1990	55.5	55.3	8.4	25.2	68.9	41.7	124.4

Source: Statistics Canada. Corporation Financial Statistics. Cat. No. 61–207; Monthly Survey of Manufacturing, Cat. No. 31–001

Notes: (1)Inventories are defined by Statistics Canada as representing the book value of owned inventory held in Canada,

including goods in transit to the respondent or held by others on consignment of manufacturing and non–manufacturing activity.

(2)All Alberta inventories are estimated (with noted exceptions) based on the ratio of Alberta value of shipments by products to total Canadian value of shipments by product.

(3)Miscellaneous Forest Products includes particleboard (eg. OSB) producers. (4) Alberta pulp and paper inventories for 1979 to 1982 were reported by Statistics Canada.

Table 2.0

RATES OF RETURN ON SELECTED SECURITIES, TSE300, AND TOTAL CANADIAN FORESTRY EQUITY

(percent)

	Gov. of Canada Securities			TSE300 Stocks	Scotia, Mcleod Weir Corporates Bond Rate weighted long-term	Estimated Returns on Equity Total Canadian Forest Industry
	T-Bills		Ave. 10 Year Gov. Bond Yield			
	90-day Bank of Canada	6 month				
1979	11.41	11.77	10.21	44.77	10.92	15.59
1980	14.97	12.78	12.48	30.13	13.28	17.35
1981	18.41	17.49	15.22	-10.25	16.32	14.31
1982	13.66	13.75	14.26	5.54	15.86	-3.87
1983	9.31	9.48	11.79	35.49	12.74	-2.80
1984	11.06	11.40	12.75	-2.39	13.50	7.13
1985	9.43	9.76	11.04	25.07	11.74	5.07
1986	8.97	9.14	9.52	8.95	10.27	11.89
1987	8.15	8.63	9.95	5.88	10.71	17.57
1988	9.48	9.79	10.22	11.08	10.91	20.30
1989	12.06	12.03	9.92	21.37	10.81	12.70
1990	13.02	13.00	10.91	-14.80	11.93	n/a
Average	11.66	11.59	11.52	13.40	12.42	9.60

Sources: Bank of Canada Review B14007, B14008 and B14048, Scotia-McLeod

(1) Returns on Equity of Total Canadian Forest Industry are as per table 3.0 (appendix).

RATES OF RETURN ON EQUITY OF SELECTIVE FORESTRY COMPANIES

(per cent, current)

Year	Canadian firms			U.S. firms		Japanese firms
	Weldwood	Canfor	Crestbrook	Procter & Gamble	Weyerhaeuser	Daishowa
1979	n/a	n/a	n/a	n/a	21.4	n/a
1980	n/a	n/a	n/a	n/a	11.8	n/a
1981	n/a	n/a	n/a	n/a	7.8	n/a
1982	-9.3	-24.3	-9.9	n/a	4.2	n/a
1983	6.3	-9.5	9.3	n/a	6.3	9.7
1984	-3.3	-25.4	-18.7	19.5	7.0	32.9
1985	4.9	8.3	16.3	12.5	6.1	20.9
1986	19.1	35.3	66.8	13.4	8.7	11.3
1987	25.9	47.7	47.7	5.5	13.5	18.7
1988	22.3	21.3	39.7	17.6	15.5	26.0
1989	15.8	15.8	30.6	18.8	8.5	n/a
1990	n/a	n/a	n/a	n/a	n/a	n/a
Average	10.21	8.65	22.73	14.55	10.07	19.92

Source: Price Waterhouse. Forest Products Industry – Survey of 1989.

Worldscope: Industrial Company Profiles, Asia, Africa, Australia, U.S., Canada, 1990 Edition,

Wright Investors Services, Bridgeport, CT., USA

Table 3.0

Estimation of Returns on Equity of Canadian Forest Industry
(millions of current dollars)

Forest Industry/Year		Net Income (loss) after taxes (1)	Dividends Stock and Cash (2)	Equity Preferred Shares (3)	Total Equity (4)	Estimates of Return on Equity [(1)-(2)]/[(3)-(4)]
Sawmills and planing mills						
	1979	402.3	0.0	78.1	1331.8	0.3209
	1980	148.5	0.0	122.4	1432.7	0.1133
	1981	-31.3	0.0	126.5	1327.8	-0.0261
	1982	-183.2	0.0	219.2	1279.1	-0.1728
	1983	98.9	6.7	188.7	1271.5	0.0851
	1984	50.4	7.2	187.0	1330.9	0.0378
	1985	212.9	6.7	306.0	1538.8	0.1673
	1986	330.9	2.6	271.3	1840.2	0.2093
	1987	558.7	6.0	482.0	2637.8	0.2564
	1988	n/a	n/a	n/a	n/a	n/a
	1989	n/a	n/a	n/a	n/a	n/a
	1990	n/a	n/a	n/a	n/a	n/a
Veneer and Plywood						
	1979	65.0	0.0	18.2	282.9	0.2456
	1980	30.3	0.0	16.5	289.1	0.1112
	1981	7.7	0.0	5.7	236.8	0.0333
	1982	-37.7	0.0	7.0	222.0	-0.1753
	1983	10.2	0.0	10.4	214.1	0.0501
	1984	5.1	0.0	28.8	221.1	0.0265
	1985	-7.8	0.0	42.5	201.0	-0.0492
	1986	54.3	0.3	43.4	249.8	0.2616
	1987	62.9	0.0	65.0	318.3	0.2483
	1988	n/a	n/a	n/a	n/a	n/a
	1989	n/a	n/a	n/a	n/a	n/a
	1990	n/a	n/a	n/a	n/a	n/a

Table 3.0

Estimation of Returns on Equity of Canadian Forest Industry
(millions of current dollars)

Forest Industry/Year		Net Income (loss) after taxes (1)	Dividends Stock and Cash (2)	Equity Preferred Shares (3)	Total Equity (4)	Estimates of Return on Equity [(1)-(2)]/[(3)-(4)]
Miscellaneous Wood Products						
	1979	21.8	0.0	19.3	109.7	0.2412
	1980	17.4	1.1	28.8	132.3	0.1575
	1981	1.0	0.0	33.4	136.5	0.0097
	1982	6.4	0.0	39.9	154.2	0.0560
	1983	-10.2	0.0	37.2	150.2	-0.0903
	1984	15.7	0.0	24.0	142.9	0.1320
	1985	15.7	0.4	46.9	178.8	0.1160
	1986	25.3	0.0	64.5	232.3	0.1508
	1987	37.3	0.0	50.3	259.9	0.1780
	1988	n/a	n/a	n/a	n/a	n/a
	1989	n/a	n/a	n/a	n/a	n/a
	1990	n/a	n/a	n/a	n/a	n/a
Total Wood Industries						
	1979	546.2	10.6	224.8	2190.4	0.2725
	1980	241.6	19.9	185.4	2196.3	0.1102
	1981	35.7	14.8	183.5	2053.0	0.0112
	1982	-190.3	35.5	276.2	1929.3	-0.1366
	1983	-167.4	26.2	265.9	1909.9	-0.1178
	1984	136.7	39.9	295.3	1996.5	0.0569
	1985	296.0	80.0	462.1	2256.0	0.1204
	1986	532.0	31.9	475.3	2782.4	0.2168
	1987	821.2	18.3	693.6	3799.6	0.2585
	1988	n/a	n/a	n/a	n/a	n/a
	1989	n/a	n/a	n/a	n/a	n/a
	1990	n/a	n/a	n/a	n/a	n/a

Table 3.0

Estimation of Returns on Equity of Canadian Forest Industry
(millions of current dollars)

Forest Industry/Year	Net Income (loss) after taxes (1)	Dividends Stock and Cash (2)	Equity Preferred Shares (3)	Total Equity (4)	Estimates of Return on Equity [(1)-(2)]/[(3)-(4)]
Pulp and Paper mills					
1979	815.8	0.0	944.0	6088.7	0.1586
1980	1438.5	0.0	938.7	7123.5	0.2326
1981	1385.9	0.0	1034.6	7361.5	0.2190
1982	-52.2	19.7	1191.9	7094.1	-0.0122
1983	-86.7	53.4	1267.4	7193.7	-0.0236
1984	553.9	82.3	1791.5	8454.8	0.0708
1985	312.3	36.5	1726.9	8821.4	0.0389
1986	1041.0	9.5	2077.4	10806.2	0.1182
1987	2179.8	2.0	2074.9	13176.5	0.1962
1988	n/a	n/a	n/a	n/a	n/a
1989	n/a	n/a	n/a	n/a	n/a
1990	n/a	n/a	n/a	n/a	n/a
Total Paper and Allied					
1979	905.4	136.5	1003.4	7231.5	0.1235
1980	1603.8	247.9	1023.1	8372.2	0.1845
1981	1536.1	537.5	1135.5	8931.6	0.1281
1982	27.6	197.5	1265.5	8485.9	-0.0235
1983	32.3	97.7	1350.4	8608.9	-0.0090
1984	713.7	177.6	1875.6	9888.5	0.0669
1985	460.2	117.3	1841.6	10334.9	0.0404
1986	1227.3	232.7	2274.6	12404.7	0.0982
1987	2391.3	351.6	2210.1	14913.3	0.1606
1988	n/a	n/a	n/a	n/a	n/a
1989	n/a	n/a	n/a	n/a	n/a
1990	n/a	n/a	n/a	n/a	n/a

Table 3.0

Estimation of Returns on Equity of Canadian Forest Industry
(millions of current dollars)

Forest Industry/Year	Net Income (loss) after taxes (1)	Dividends Stock and Cash (2)	Equity Preferred Shares (3)	Total Equity (4)	Estimates of Return on Equity [(1)-(2)]/[(3)-(4)]
Total Canadian Forest Industries					
1979	1451.6	174.2	1228.2	9421.9	0.1559
1980	1845.4	221.4	1208.5	10568.5	0.1735
1981	1571.8	188.6	1319.0	10984.6	0.1431
1982	-162.7	181.0	1541.7	10415.2	-0.0387
1983	-135.1	114.0	1616.3	10518.8	-0.0280
1984	850.4	158.0	2170.9	11885.0	0.0713
1985	756.2	235.0	2303.7	12590.9	0.0507
1986	1759.3	280.0	2749.9	15187.1	0.1189
1987	3212.5	435.0	2903.7	18712.9	0.1757
1988	n/a	n/a	n/a	n/a	0.1090
1989	n/a	n/a	n/a	n/a	0.2030
1990	n/a	n/a	n/a	n/a	n/a

Source: Statistics Canada. Various issues. Corporation Financial Statistics. Cat.No. 61–207.

Price Waterhouse. Various issues. Forest Products Industry Survey. 1983–1990.

Notes: (1) Dividends include stock (preferred share) dividends and cash dividends as per Statistics Canada Cat. No. 61–207.

(2) Preferred share dividends for Wood and Paper and Allied Industries are estimated based on a ratio of industry income (loss) to total industry income (loss).

(3) 1988 and 1989 Return on Equity are as per Price Waterhouse 1989 report.

(4) Dividends are all stock or cash dividends received from Canadian and foreign coporations as reported by Statistics Canada Cat.No. 61–208. Corporate Financial Statistics.

Table 4.0

Stock Price Betas of 20 Canadian Forestry Companies

Company/ Year	5 Year Betas (1985-1990)	1 Year Betas (1990)
Canfor Corp.	1.77	1.64
Malette Inc.	1.66	0.70
Crestbrook Forest Ind.	1.64	1.73
International Forest Products	1.54	1.92
Macmillan Bloedel Ltd.	1.51	1.50
Doman Industries	1.34	1.24
Cascades Inc.	1.31	1.75
Domtar Inc.	1.29	0.79
Fletcher Challenge Canada	1.29	1.53
Tembec Inc.	1.12	0.67
C.P. Forest Products	1.09	1.12
Donohue Inc.	1.02	0.78
Abitibi-Price Inc.	0.84	0.65
Scott Paper Ltd.	0.80	0.44
Weldwood of Canada	0.80	0.74
Westar Group Ltd.	0.67	1.94
West Fraser Timber Co.	n/a	0.73
Slocan Forest Products	n/a	1.24
Repap Enterprises Inc.	n/a	1.57
Noranda Forest Inc.	n/a	1.96
Equal weight average	1.23	1.23
TSE weighted average	1.29	1.26

Source: Computerized Portfolio Management Services Inc. (C.P.M.S.), Toronto,Ontario.

Notes: Stock price betas represent the systematic risk of a stock relative to other stocks trading on the Toronto Stock Exchange. The larger the beta, the greater the risk associated with the stoc A beta of 1.0 suggests that a stock is at least as risky as the risk associated with the entire TSE 300 stock portfoli

Table 5.0

Average Variable Costs for Alberta Softwood Lumber Mills
(Can$ per 1000 board feet (Mfbm), in current $s)

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990
Delivered Wood Costs	111	102	108	114	113	97	112	125	130
Labour (direct, indirect and maintenance)	56	54	56	53	51	50	50	50	51
Energy	12	12	10	8	9	9	9	10	11
Miscellaneous (supplies, etc.)	29	31	30	27	24	22	24	31	33
GROSS VARIABLE COSTS	208	199	204	202	197	178	195	216	225
Residue Income (chip sales)	34	25	27	21	20	23	26	31	30
NET VARIABLE COSTS	174	174	177	181	177	155	169	185	195
GENERAL & ADMINISTRATIVE	6	5	5	5	5	5	5	5	5
TOTAL AVERAGE VARIABLE COSTS	180	179	182	186	182	160	174	190	200

(1)SOURCE: STATISTICS CANADA - HISTORICAL DATA THROUGH 1982; FORSIM ESTIMATES FOR SUBSEQUENT HISTORY;

(2)TOTAL DELIVERED WOOD COSTS INCLUDE STUMPAGE, HARVEST AND DELIVERY COSTS BEFORE THE SALE OF RESIDUES. STUMPAGE COSTS ARE NOT CURRENTLY BROKEN OUT BECAUSE OF LACK OF ADEQUATE DATA FOR MOST CANADIAN PROVINCES;

(3)LABOUR COST INCLUDES WAGES, SALARIES AND BENEFITS; (4) ENERGY COSTS INCLUDE PURCHASED AND SELF-GENERATED ENERGY;

(5)MISCELLANEOUS COSTS INCLUDE MAINTENANCE AND REPAIR SUPPLIES, AND OTHER PACKAGING MATERIALS & SUPPLIES;

(6)GROSS VARIABLE COSTS ARE THE SUM OF WOOD, LABOUR, ENERGY AND MISCELLANEOUS COSTS; (7) RESIDUE INCOME IS OFFSETTING REVENUE FROM THE SALE OF CHIPS, SAWDUST AND OTHER RESIDUES; (8) NET VARIABLE COSTS=GROSS VARIABLE COSTS - RESIDUE INCOME; (9) GENERAL AND ADMINISTRATIVE COSTS INCLUDE CLERICAL, SALES, DISTRIBUTION AND ADMIN. OVERHEAD; (10) TOTAL AVE. VARIABLE COSTS = NET VARIABLE COSTS + GENERAL & ADMIN. OVERHEAD.

Table 6.0

Average Total Costs for British Columbia–Interior – Bleached Kraft Pulp Mills
(in Can$ per ADMT (air dry metric tonne, current $s)

Average Total costs (Delivered to U.S. N. East)	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Wood	87	130	162	161	128	143	127	133	158	170	189	211
Labour	44	49	53	60	62	61	61	61	61	60	62	64
Energy	25	29	33	42	45	45	44	38	33	30	29	30
Chemicals	34	39	47	52	53	55	56	56	56	59	62	62
Other Materials	39	44	48	52	53	55	57	57	58	60	61	61
AVERAGE VARIABLE COSTS	229	291	343	367	341	359	345	345	366	379	403	428
Transportation Costs	81	98	98	88	89	90	88	80	82	91	98	97
Overhead	33	38	44	51	55	58	57	53	52	53	55	56
AVERAGE TOTAL COSTS	343	427	485	506	485	507	490	478	500	523	556	581

(1) SOURCE: RESOURCE INFORMATION SYSTEMS, INC., PULP AND PAPER REVIEW – 1990 YEARBOOK

(2) WOOD COSTS ARE DELIVERED WOOD COSTS AND INCLUDE STUMPAGE FEES AND REFORESTATION COSTS.

(3) LABOUR COST INCLUDES WAGES, SALARIES AND BENEFITS; (4) ENERGY COSTS INCLUDE PURCHASED AND SELF–GENERATED ENERGY;

(5) TRANSPORTATION COSTS INCLUDES COST OF RAIL TRANSPORT TO U.S NORTH EAST MARKETS;

(6) AVERAGE VARIABLE COSTS IS THE SUM OF WOOD,LABOUR,ENERGY,CHEMICALS,OTHER MATERIALS, AND TRANSPORTATION;

(7) ADMIN. OVERHEAD INCLUDES CLERICAL, SALES, DISTRIBUTION AND ADMIN. OVERHEAD; (8) AVERAGE TOTAL COSTS = AVE. VARIABLE COSTS + ADMIN. OVERHEAD

Table 7.0

Average Variable Costs for Ontario and Quebec OSB/Waferboard Mills
($Can per 1000 square feet, 3/8 inch basis, in current dollars)

Year/Cost Category	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Delivered Wood Costs	26.55	28.39	29.49	30.83	39.35	44.13	44.63	44.77	43.24	46.62	45.92	44.64
Labour	12.33	13.61	14.94	16.12	20.15	20.37	20.57	21.62	21.27	21.44	22.1	22.79
Energy	2.37	3.28	3.83	3.20	3.94	4.54	6.31	4.89	5.24	5.78	6.42	6.54
Glue	11.71	19.16	20.33	19.98	23.80	22.48	22.25	18.30	18.79	18.44	19.13	19.76
Wax	3.05	3.47	3.73	3.84	4.90	5.13	5.27	4.31	5.44	5.68	5.91	6.10
Miscellaneous	10.32	11.73	12.60	12.99	16.56	17.33	17.80	17.96	18.39	19.20	19.98	20.63
GROSS VARIABLE COSTS	66.33	79.64	84.92	86.96	108.70	113.98	116.83	111.85	112.37	117.16	119.46	120.46
General & Administrative Costs	4.00	4.00	4.05	4.15	5.19	5.48	5.66	5.51	5.62	5.86	5.87	6.06
TOTAL AVERAGE VARIABLE COSTS	70.33	83.64	88.97	91.11	113.89	119.46	122.49	117.36	117.99	123.02	125.33	126.52

(1) SOURCE: RESOURCE INFORMATION SYSTEMS, INC. AND INDUSTRY SURVEYS

(2) COSTS FOR 1979 TO 1982 ARE FOR WAFERBOARD, COSTS FROM 1983 TO 1990 ARE FOR OSB MILLS

(3) PRICE AND CONVERSION ASSUMPTIONS USED TO DERIVE THE WOOD, LABOR, ENERGY AND GLUE COSTS ARE OUTLINED IN THE TABLE ENTITLED "FACTOR INPUT PRICE AND CONVERSION ASSUMPTIONS."

(4) WAX, MISCELLANEOUS, AND GENERAL & ADMINISTRATIVE COSTS ARE FORECAST USING SEPARATE COST ESCALATOR INDICES FOR EACH COST; (5) GROSS VARIABLE COSTS EQUAL THE SUM OF WOOD, LABOUR, ENERGY, GLUE, WAX AND MISC. EXPENSES

(6) TOTAL AVERAGE VARIABLE COSTS EQUAL THE SUM OF GROSS VARIABLE AND GENERAL & ADMINISTRATIVE COST.

Table 8.0

Average Variable Costs for British Columbia Plywood Mills

($Can per 1000 square feet, 3/8 inch basis)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Delivered Wood Costs	75	79	82	76	72	76	71	70	86	94	94	93
Labour	60	64	70	79	74	71	71	71	70	71	73	75
Energy	6	7	9	11	10	11	12	13	14	15	15	16
Glue	11	13	14	14	15	16	15	13	15	14	15	15
Supplies (Operations & Maintenance)	20	22	26	28	20	22	22	22	22	23	24	25
GROSS VARIABLE COSTS	172	185	201	208	191	196	191	189	207	217	221	224
Residue Income	14	21	21	19	13	13	12	10	11	11	13	13
NET VARIABLE COSTS	158	164	180	189	178	183	179	179	196	206	208	211
General & Administration Costs	8	10	14	15	11	10	10	10	10	11	11	11
TOTAL AVERAGE VARIABLE COSTS	166	174	194	204	189	193	188	189	206	217	218	223

SOURCE: FORSIM ANNUAL REPORT, RESOURCE INFORMATION SYSTEMS, INC., INDUSTRY SURVEYS, STATISTICS CANADA, VENEER AND PLYWOOD MILLS, CAT NO 35-206 ANNUAL

NOTES: (1) AVERAGE COSTS ARE CALCULATED FOR ALL PRODUCTION, ROUGH AND SANDED

(2) WOOD COSTS ARE GROSS, INCLUSIVE OF VENEER PURCHASES BUT EXCLUSIVE OF REVENUES GENERATED FROM THE SALES OF CHIPS AND CORES

(3) LABOUR COSTS INCLUDE BENEFITS AND WAGES FOR ALL PRODUCTION AND RELATED WORKERS BUT EXCLUDE SALARIED PERSONNEL. THIS EXPENSE IS COVERED UNDER GENERAL AND ADMINISTRATI

(4) ENERGY IS PURCHASED ENERGY (PRIMARILY ELECTRICITY)

(5) GLUE COSTS ARE UNIT AVERAGES FOR ALL CANADA. (6) MISCELLANEOUS COSTS INCLUDE: OTHER MATERIALS, PACKAGING, OPERATING AND MAINTENANCE SUPPLIES

(7) RESIDUE INCOME IS THE REVENUE GENERATED FROM THE SALE OF CHIPS AND CORES PER MSF, 3/8 INCH. (8) NET VARIABLE COSTS EQUAL GROSS VARIABLE COSTS LESS RESIDUE INCOME

(9) GENERAL & ADMINISTRATIVE COST IS THE SALARIED EXPENSE ASSOCIATED WITH RUNNING THE PRODUCTION FACILITY, EXCLUSIVE OF CORPORATE OVERHEAD

(10) TOTAL VARIABLE COSTS ARE NET COSTS PLUS GENERAL & ADMINISTRATIVE COSTS

Table 9.0

ESTIMATED ALBERTA FOREST PRODUCT PRODUCTION (1979–1990) STATISTICS CANADA

Year		Pulp and Paper							
		Total Pulp							
Units	Lumber (Mfbm)	(ADMT)	SBKP (ADMT)	HBKP (ADMT)	CTMP (ADMT)	Newsprint (tonnes)	Plywood (Msf, 3/8")	Waferboard & OSB (Msf, 3/8")	MDF (Msf, 3/4")
1979	999,200	490,000	490,000	0	0	0	150,000	125,000	0
1980	1,057,100	490,000	490,000	0	0	0	175,000	125,000	0
1981	1,198,100	490,000	490,000	0	0	0	200,000	125,000	0
1982	1,088,500	502,433	502,433	0	0	0	200,000	125,000	0
1983	1,554,800	541,331	541,331	n/a	0	0	223,000	255,000	0
1984	1,481,500	578,883	578,883	n/a	0	0	223,000	373,000	0
1985	1,655,200	610,093	610,093	n/a	0	0	223,400	373,000	0
1986	1,813,500	595,171	595,171	n/a	0	0	230,000	371,000	47,710
1987	2,209,600	633,560	633,560	n/a	0	0	230,000	607,300	50,000
1988	2,348,800	650,944	650,944	n/a	0	0	223,000	662,000	50,000
1989	2,204,500	714,380	612,000	n/a	102,380	0	226,641	661,980	50,000
1990	2,176,700	1,092,903	737,925	149,520	205,458	60,000	226,641	661,980	50,000

Source: Statistics Canada Cat. No. 25–201, 25–202, 35–250, 36–250, 25–001

Bamsey, C.R. (1989) Directory of Wood–Using Industies in Alberta.

Notes:(1) Waferboard production based on estimates of production of one mill which was converted to an OSB mill in 1986 and has subsequently closed in 1991.

(2) n/a – Hardwood Kraft Pulp was being produced by Procter and Gamble since 1983 however no production figures are available therefore HBKP production from 1983 to 1989 are included with SBKP production. 1990 pulp production is estimated based on various sources included Pulp and Paper Journal, Pulp and Paper Week periodicals which reported productions of CTMP and newsprint. SBKP production for 1990 includes some HBKP produced by Procter and Gamble's mill (volume unknown) and also includes 125,505 ADMT of new capacity production from Daishowa and Weldwood's mills.

Table 10.0

APPARENT ALBERTA FOREST PRODUCT PRODUCTION BASED ON CUBIC METERS OF WOOD INPUT (1979-1990)

(cubic meters of wood input)

Year		Pulp and Paper								
		Total Pulp						Waferboard		TOTAL FOREST
	Lumber		SBKP	HBKP	CTMP	Newsprint	Plywood	& OSB	MDF	PRODUCTS
1979	4,288,412	2,743,561	2,743,561	0	0	0	223,881	228,519	0	7,484,373
1980	4,536,910	2,743,561	2,743,561	0	0	0	261,194	228,519	0	7,770,184
1981	5,142,060	2,743,561	2,743,561	0	0	0	298,507	228,519	0	8,412,648
1982	4,671,674	2,813,173	2,813,173	0	0	0	298,507	228,519	0	8,011,873
1983	6,672,961	3,030,967	3,030,967	0	0	0	332,836	433,673	0	10,470,438
1984	6,358,369	3,241,225	3,241,225	0	0	0	332,836	634,354	0	10,566,784
1985	7,103,863	3,415,974	3,415,974	0	0	0	333,433	634,354	0	11,487,623
1986	7,783,262	3,332,423	3,332,423	0	0	0	343,284	630,952	0	12,137,631
1987	9,483,262	3,547,369	3,547,369	0	0	0	343,284	1,032,823	225,023	14,456,738
1988	10,080,687	3,644,706	3,644,706	0	0	0	332,836	1,125,850	225,023	15,234,079
1989	9,461,373	3,933,279	3,426,652	0	276,479	0	338,270	1,125,816	225,023	14,678,590
1990	9,342,060	4,818,344	4,131,719	704,618	554,842	162,031	338,270	1,125,816	225,023	16,409,357
Average	7,077,074	3,334,012	3,234,574	352,309	415,660	162,031	314,761	638,143	180,018	11,426,693

Source: Statistics Canada Cat. No. 25–201, 25–202, 35–250, 36–250, 25–001

Bamsey, C.R. (1988 and 1986). Directory of Wood–using Industries in Alberta. Alberta.

Notes: (1) The wood inputs are termed "apparent" because the data is based on the volume of forest products produced then converted to the required roundwood wood input according to the appropriate conversion factors for respective products (see table 12.0 (appendix)).

Table 11.0

Statistics Canada Reported Pulpwood and Residue Production, Consumption and Apparent Pulp Production for Alberta

(cubic meters and converted to air dry metric tonnes of pulp)

Year	Pulpwood and Residue Production				Consumption	Apparent Production
	Pulpwood (m3)	Chips (m3)	Other Residue (m3)	Total (m3)	(m3)	(ADMT)
1979	n/a	n/a	n/a	n/a	n/a	490,000
1980	n/a	n/a	n/a	n/a	n/a	490,000
1981	n/a	n/a	n/a	n/a	n/a	490,000
1982	1,801,339	878,731	5,534	2,685,604	2,813,173	502,443
1983	1,623,179	1,312,130	0	2,935,309	3,030,967	547,441
1984	1,380,948	1,681,739	0	3,062,687	3,241,225	581,932
1985	2,040,551	1,533,088	0	3,573,639	3,415,974	617,439
1986	2,022,506	1,532,505	507	3,555,518	3,332,423	595,171
1987	1,496,685	1,823,978	89,175	3,409,838	3,547,369	638,304
1988	1,772,500	n/a	142,925	1,915,425	3,644,706	662,676
1989	1,766,727	2,286,265	0	4,052,992	3,933,279	714,774
1990	2,136,082	2,581,813	0	4,717,895	4,818,344	1,092,900

Source: Statistics Canada Cat. No. 25–001, Pulp and Paper Week (various issues) and Pulp and Paper Journal (various issues).

(1) Apparent consumption is based on converting consumption figures to air dry metric tonnes of SBKP and HBKP pulp (ADMT) using a conversion factor of 0.1786 ADMT/cubic meter of wood input for Softwood BKP and 0.2122 ADMT/cubic meter for Hardwood BKP. Small amount of Hardwood BKP production (roughly 6 per cent of total production) is built into the figures for production.

(2) 1979 to 1981 figures are estimated from Bamsey (1986) and Ondro and Williamson (1981).

(3) 1990 apparent production figure is adjusted upwards to reflect new production from new mills as reported from other in several sources including Pulp and Paper Week and Pulp and Paper Journal.

Table 12.0

Conversion Factors

Lumber (coniferous)	1 cubic meter (roundwood, coniferous) = 0.233 thousand board feet (Mfbm) lumber
Plywood	1 cubic meter (roundwood, coniferous) = 0.670 thousand square feet (Msf), 3/8 inch plywood
Oriented strandboard	1 cubic meter roundwood (aspen) = 0.588 thousand square feet (Msf), 3/8 inch strandboard
Waferboard	1 cubic meter (roundwood, coniferous) = 0.670 thousand square feet (Msf), 3/8 inch waferboard
Medium Density Fibreboard	1 cubic meter (roundwood) = 0.2222 thousand square feet (Msf), 3/4 inch fibreboard
Softwood Bleached Kraft Pulp	1 cubic meter (roundwood, spruce) = 0.1686 air dry metric tonnes (ADMT) of SBK pulp
	1 cubic meter (roundwood, pine) = 0.1885 air dry metric tonnes (ADMT) of SBK pulp
	1 cubic meter (roundwood, 50 % spruce/50 % pine) = 0.1786 air dry metric tonnes (ADMT) of SBK pulp
Hardwood Bleached Kraft Pulp	1 cubic meter (roundwood, aspen) = 0.2122 air dry metric tonnes (ADMT) of HBK pulp
Chemi-thermomechanical Pulp (CTMP)	1 cubic meter (roundwood) = 0.3703 air dry metric tonnes (ADMT) of CTM pulp
Newsprint	1 cubic meter (roundwood) = 0.3703 air dry metric tonnes of newsprint

Source: Alberta Forest Service (1988). Forest Products Conversion Factors. Alberta Forestry, Lands and Wildlife;
Forest Industry Development Division, Alberta Forestry, Lands and Wildlife.

Table 13.0

Economic Indicators

Year	Implicit Price Index Gross Domestic Product 1986=100.0		Exchange Rate ($Can/$US)
	Canada	Alberta	
1979	66.0	72.8	1.171
1980	73.0	84.2	1.169
1981	80.9	92.0	1.199
1982	87.9	102.6	1.234
1983	92.3	108.6	1.232
1984	95.2	11.0	1.295
1985	97.7	113.1	1.366
1986	100.0	100.0	1.389
1987	104.8	102.1	1.326
1988	109.9	100.3	1.231
1989	115.2	105.7	1.184
1990	118.9	n/a	1.167
1991			1.194
1992			1.215
1993			1.218
1994			1.212
1995			1.205
1996			1.198
1997			1.193
1998			1.190
1999			1.183
2000			1.176

Source: Bank of Canada; Canadian Economic Observer, Historical Statistical Supplement 1989/90, Catalogue 11-210, Vol. 3, July 1990, Catalogue 11-210, Vol.3, July 1990, Minister of Supply and Servic[illegible]Ottawa.

Notes: p – projected

(1) 1990 GDP Implicit Price Index Canada is estimated based on 3 quarters of 1990 reported.

(2) Exchange rates for 1991 to 2000 are based on RISI projections.

Table 14.0

Comparison of Economics Rents in Wood Industries Using Residual Valuation Approach vs. Value-Added Approach

(constant 1986 dollars)

Year	Lumber		Plywood		OSB		MDF		TOTAL WOOD INDUSTRIES		
	RV	VADD	RV	VADD	RV	VADD	RV	VADD	RV	VADD (1)	VADD (2)
1979	79,194.2	38,787.9	1,313.6	11,818.2	18,191.4	*	0.0	*	98,699.2	50,606.1	115,606.1
1980	3,185.8	(23,561.6)	(4,876.0)	1,232.9	10,205.5	*	0.0	*	8,515.2	(22,328.8)	50,684.9
1981	(9,093.1)	(43,881.3)	(2,855.4)	5,809.6	3,518.3	*	0.0	*	(8,430.2)	(38,071.7)	63,906.1
1982	(70,139.5)	(61,319.7)	(15,870.3)	682.6	2,340.7	*	0.0	*	(83,669.1)	(60,637.1)	(28,327.6)
1983	10,629.3	5,850.5	(2,580.3)	5,308.8	3,482.2	*	0.0	*	11,531.2	11,159.3	50,704.2
1984	(27,778.2)	(1,995.8)	(7,980.7)	(1,890.8)	7,413.0	*	0.0	*	(28,345.8)	(3,886.6)	41,596.6
1985	(25,192.2)	(1,842.4)	(409.3)	614.1	13,144.7	*	0.0	*	(12,456.8)	(1,228.2)	68,884.3
1986	7,888.7	22,600.0	12,790.3	7,300.0	11,315.5	*	5,289.6	*	37,284.1	29,900.0	96,200.0
1987	37,381.9	28,530.5	4,426.6	12,309.2	14,151.0	*	4,903.1	*	60,862.7	40,839.7	100,667.9
1988	8,506.1	46,860.8	(3,222.2)	19,199.3	(13,366.5)	*	3,297.1	*	(4,785.5)	66,060.1	81,619.7
1989	(59,973.1)	45,920.1	(381.7)	19,531.3	5,907.3	*	1,718.3	*	(52,729.2)	65,451.4	85,503.5
1990	(87,818.6)	45,248.1	436.5	23,044.6	(16,513.3)	*	1,251.5	*	(102,643.9)	68,292.7	87,720.8
Average	(11,100.7)	8,433.1	(1,600.7)	8,746.6	4,982.5	*	2,792.5	*	(6,347.3)	17,179.7	67,897.2

Notes: * Value added figures for OSB and MDF rents are included in Plywood VADD figures.

(1) VADD(1) for Total Wood Industries is value added approach figures for sawmills and planing mills, and plywood (plus other panelboard) products.

(2) VADD(2) is value added approach figures for total wood industries which includes sawmills and planing mills, plywood and veneer and other secondary wood-using manu

(3) RV or Residual Valuation Approach figures for Total Wood Industries is equal to lumber + plywood + OSB + MDF.

Table 15.0

Comparison of Economic Rents in Paper and Allied Industries Using Residual Valuation Approach vs. Value-Added Approach

(constant 1986 dollars)

Year	Pulp						Newsprint		Logging		TOTAL PULP AND PAPER INDUSTRIES		Total Paper & Allied
	SBKP		HBKP		CTMP								
	RV	VADD	RV	VADD	RV	VADD	RV	VADD	RV	VADD	RV	VADD(1)	VADD(2)
1979	50,083.9	n/a	0.0	n/a	0.0	n/a	0.0	n/a	n.a.	11,818	50,084	27,727	50,455
1980	53,839.6	n/a	0.0	n/a	0.0	n/a	0.0	n/a	n.a.	7,945	53,840	41,918	73,425
1981	28,836.7	n/a	0.0	n/a	0.0	n/a	0.0	n/a	n.a.	19,407	28,837	38,690	79,975
1982	(4,201.3)	n/a	0.0	n/a	0.0	n/a	0.0	n/a	n.a.	3,868	(4,201)	41,411	71,104
1983	(43,233.5)	n/a	0.0	n/a	0.0	n/a	0.0	n/a	n.a.	5,092	(43,233)	17,335	37,378
1984	39,062.4	n/a	0.0	n/a	0.0	n/a	0.0	n/a	n.a.	1,155	39,062	70,273	90,756
1985	20,107.5	n/a	0.0	n/a	0.0	n/a	0.0	n/a	n.a.	2,661	20,107	11,668	63,971
1986	16,516.0	n/a	0.0	n/a	0.0	n/a	0.0	n/a	n.a.	9,800	16,516	4,700	43,600
1987	106,242.3	n/a	0.0	n/a	0.0	n/a	0.0	n/a	n.a.	27,576	106,242	86,164	126,622
1988	142,414.1	n/a	0.0	n/a	0.0	n/a	0.0	n/a	n.a.	24,295	142,414	114,650	182,166
1989	146,837.5	n/a	0.0	n/a	21,722.8	n/a	0.0	n/a	n.a.	14,236	168,560	46,007	119,271
1990	84,386.6	n/a	(4,153.6)	n/a	2,951.4	n/a	3,481.9	n/a	n.a.	19,680	86,666	(60,219)	(20,185)
Average	53,407.7	n/a	(4,153.6)	n/a	12,337.1	n/a	3,481.9	n/a	n.a.	12,294.5	55,407.9	36,694	76,545

Notes: n/a – not availabe, included in total pulp and paper industries figures; n.a. – not applicable.

(1) VADD (1) is value added for only pulp and paper mills plus logging activity rents.

(2) VADD(2) is value added for paper and allied industries, that includes secondary wood–using industries, plus logging.

(3) Logging activity is reported only for value added rents and is generally associated with pulp and paper industries.
Residual valuation figures already have logging activity rents built into the figures.

Table 16.0

Comparison of Economics Rents in Wood Industries Using Residual Valuation Approach vs. Value-Added Approach

(constant 1986 dollars per cubic meter of wood input)

Year	Lumber		Panelboard						Total Panelboard		TOTAL WOOD INDUSTRIES		
			Plywood		OSB		MDF						
	RV	VADD	RV	VADD	RV	VADD	RV	VADD	RV	VADD	RV	VADD (1)	VADD (2)
1979	18.47	9.04	5.87	52.79	79.61	*	0.00	*	43.11	26.12	20.82	10.67	24.39
1980	0.70	-5.19	-18.67	4.72	44.66	*	0.00	*	10.88	2.52	1.69	-4.44	10.08
1981	-1.77	-8.53	-9.57	19.46	15.40	*	0.00	*	1.26	11.02	-1.49	-6.72	11.27
1982	-15.01	-13.13	-53.17	2.29	10.24	*	0.00	*	-25.67	1.30	-16.09	-11.66	-5.45
1983	1.59	0.88	-7.75	15.95	8.03	*	0.00	*	1.18	6.93	1.55	1.50	6.82
1984	-4.37	-0.31	-23.98	-5.68	11.69	*	0.00	*	-0.59	-1.95	-3.87	-0.53	5.68
1985	-3.55	-0.26	-1.23	1.84	20.72	*	0.00	*	13.16	0.63	-1.54	-0.15	8.53
1986	1.01	2.90	37.26	21.27	17.93	*	0.00	*	30.17	7.49	4.26	3.41	10.98
1987	3.94	3.01	12.89	35.86	13.70	*	21.79	*	14.67	7.69	5.49	3.68	9.08
1988	0.84	4.65	-9.68	57.68	-11.87	*	14.65	*	-7.89	11.40	-0.41	5.62	6.94
1989	-6.34	4.85	-1.13	57.74	5.25	*	7.64	*	4.29	11.56	-4.73	5.87	7.67
1990	-9.40	4.84	1.29	68.12	-14.67	*	5.56	*	-8.78	13.64	-9.30	6.19	7.95
Average	-1.16	0.23	-5.65	27.67	16.72	*	12.41	*	6.32	8.20	-0.30	1.12	8.66

Notes: Rents per cubic meter of wood input is based on conversion of total rents to per wood input rents;

* Value added figures for OSB and MDF rents are included in Wood Industries VADD(2) figures.

(1) VADD(1) for Total Wood Industries is value added approach figures for sawmills and planing mills, and plywood (plus other panelboard) products.

(2) VADD(2) is value added approach figures for total wood industries which includes sawmills and planing mills, plywood and veneer and other secondary wood–using manufacturer

(3) RV or Residual Valuation Approach figures for Total Wood Industries is equal to lumber + plywood + OSB + MDF.

(4) Value Added figures are before indirect taxes while Residual Value figures are net of indirect taxes.

Table 17.0

Comparison of Economic Rents in Paper and Allied Industries Using Residual Valuation Approach vs. Value-Added Approach

(constant 1986 dollars per cubic meter of wood input)

Year	Pulp SBKP		HBKP		CTMP		Newsprint		Logging		TOTAL PULP AND PAPER INDUSTRIES		Total Paper & Allied
	RV	VADD	RV	VADD	RV	VADD	RV	VADD	RV	VADD	RV	VADD(1)	VADD(2)
1979	18.26	n/a	0.00	n/a	0.00	n/a	0.00	n/a	n.a.	4.31	18.26	10.11	18.39
1980	19.62	n/a	0.00	n/a	0.00	n/a	0.00	n/a	n.a.	2.90	19.62	15.28	26.76
1981	10.51	n/a	0.00	n/a	0.00	n/a	0.00	n/a	n.a.	7.07	10.51	14.10	29.15
1982	-1.49	n/a	0.00	n/a	0.00	n/a	0.00	n/a	n.a.	1.37	-1.49	14.72	25.28
1983	-14.26	n/a	0.00	n/a	0.00	n/a	0.00	n/a	n.a.	1.68	-14.26	5.72	12.33
1984	12.05	n/a	0.00	n/a	0.00	n/a	0.00	n/a	n.a.	0.36	12.05	21.68	28.00
1985	5.89	n/a	0.00	n/a	0.00	n/a	0.00	n/a	n.a.	0.78	5.89	3.42	18.73
1986	4.96	n/a	0.00	n/a	0.00	n/a	0.00	n/a	n.a.	2.94	4.96	1.41	13.08
1987	29.95	n/a	0.00	n/a	0.00	n/a	0.00	n/a	n.a.	7.77	29.95	24.29	35.69
1988	39.07	n/a	0.00	n/a	0.00	n/a	0.00	n/a	n.a.	6.67	39.07	31.46	49.98
1989	42.85	n/a	0.00	n/a	6.34	n/a	0.00	n/a	n.a.	3.62	42.85	11.70	30.32
1990	20.42	n/a	-1.01	n/a	0.71	n/a	0.84	n/a	n.a.	3.91	17.20	-11.95	-4.01
Average	15.65	n/a	-1.01	n/a	3.53	n/a	0.84	n/a	n.a.	3.61	15.38	11.83	23.64

Notes: Rents per cubic meter of wood input is based on conversion of total rents to per wood input rents;

n/a – not availabe, included in total pulp and paper industries figures; n.a. – not applicable.

(1) VADD (1) is value added for only pulp and paper mills plus logging activity rents.

(2) VADD(2) is value added for paper and allied industries, that includes secondary wood-using industries, plus logging.

(3) Logging activity is reported only for value added rents and is generally associated with pulp and paper industries.

Residual valuation figures already have logging activity rents built into the figures.

Table 18.0

Alberta Forest Production Capacity and Capital Expansion: 1986–1998

	1990	1991	1993	1995	1998
Production Capacity					
Pulp – SBKP (ADMT)	797,000	797,000	906,000	796,000	796,000
Pulp – HBKP (ADMT)	238,000	578,000	1,247,000	1,397,000	1,397,000
Pulp – BCTMP (ADMT)	320,000	320,000	320,000	320,000	580,000
Fine Paper (tonnes)	0	0	0	0	420,000
Newsprint (tonnes)	220,000	220,000	220,000	220,000	440,000
Lumber – S.P.F. (Mfbm)	1,928,000	2,148,000	2,188,000	218,000	2,180,000
Plywood (M sq.ft. 3/8")	243,700	243,700	243,700	243,700	243,700
OSB (M sq.ft. 3/8")	680,000	510,000	510,000	1,130,000	1,130,000
MDF (M sq.ft. 3/4")	50,000	50,000	50,000	50,000	50,000
Estimated Production					
Pulp – SBKP (ADMT)	757,150	757,150	860,700	756,200	756,200
Pulp – HBKP (ADMT)	226,100	549,100	1,184,650	1,327,150	1,327,150
Pulp – BCTMP (ADMT)	216,000	304,000	304,000	304,000	551,000
Fine Paper (tonnes)	0	0	0	0	210,000
Newsprint (tonnes)	45,000	176,000	176,000	180,000	336,000
Lumber – S.P.F. (Mfbm)	1,699,000	1,930,000	1,969,000	1,969,000	1,969,000
Plywood (M sq.ft. 3/8")	226,641	226,641	226,641	226,641	226,641
OSB (M sq.ft. 3/8")	661,960	496,485	496,485	1,100,055	1,100,055
MDF (M sq.ft. 3/4")	50,000	50,000	50,000	50,000	50,000
Capital Investments ($million)					
Pulp, Paper, and Newsprint	1,768	85	2,115	85	785
Lumber	0	85	0	0	0
Panelboard	0	0	0	119	0

Source: 1986 and 1987 production is based on Bamsey, C.R. (1988) and (1986). Directory of Alberta Wood–Using Industries in Alberta. and Wildlife; Forest Industry Development Division, Alberta Forestry Lands and Wildlife; Environmental Council of Alberta; Alberta Forest Products Assoc.

Notes: n/a – not available, Procter & Gamble had some HBKP production but quantity not known.

(1) Pulp production for 1991 to 1998 is estimated based on operating capacity of 95 percent of capacity.

(2) Estimates for lumber production 1991 to 1998 based on 90 percent of capacity.

(3) OSB and Plywood production from 1988 to 1998 are estimated based on 97 per cent and 93 per cent of capacity, respectively.

(4) Capital investments from Forest Industry Development Division, Alberta Forestry, Lands and Wildlife. Total capital costs of each project are reported in the year of expected production, not amortized over the construction period.

(5) OSB production falls in 1991 reflecting the closure of Weldwood's OSB plant in Slave Lake.

Table 19.0

ALBERTA FOREST INDUSTRY DEVELOPMENT – 1986–1998

Projects Announced or Pending Approval

Company Name	Product	Year/Date of Operation	Production Capacity Volume	Units	Actual Production 1987	Capital Cost ($million)	Comments
Blue Ridge	MDF	1986	50,000	sq.ft. 3/4"	50,000	32.0	
Atlas Lumber	Lumber	1986	23,000	Mfbm	20,600	2.4	
Cowley Forest Products	Lumber	1986	36,500	Mfbm	14,250	0.7	
Mostowich Lumber	Lumber	1986	10,000	Mfbm	30,000	8.0	
Pelican Spruce Mills	OSB	1987	260,000	sq.ft. 3/8"	n/a	60.0	
Blue Ridge Lumber	Lumber	1987	210,000	Mfbm	169,423	4.0	
Grande Cache Forest Prod.	Lumber	April 1989	100,000	Mfbm	96,491	5.0	
Millar Western Pulp	CTMP pulp	April 1989	210,000	ADMT	0	204.5	
Erith Tie Co.	Lumber	1989	80,000	Mfbm	32,000	20.0	
Procter & Gamble	SBKP and HBKP pulp	October 1990 ?	310,000	ADMT	300,000		expansion of pulp mill to 310,000, delayed
	Lumber	October 1989 ?	150,000	Mfbm	130,000	300.0	expansion of Grande Prairie sawmill
Weldwood of Canada	BKP pulp	April 1990	385,000	ADMT	192,000	393.0	Expansion
Daishowa of Canada	HBKP(70%)/SBKP(30%) pulp	July 1990	340,000	ADMT	0	505.0	
Alberta Newsprint	Newsprint	August 1990	220,000	tonnes	0	360.0	
AEC	CTMP pulp	November 1990	110,000	ADMT	0	168.4	
Daishowa of Canada	HBKP (70%) and SBKP (30%)	April 1991	340,000	ADMT	0	550.0	expansion into hardwood pulp
Procter & Gamble	Lumber	July 1991 ?	80,000	Mfbm	0	35.0	New mill
Weldwood of Canada	Lumber	Mid–1991	200,000	Mfbm	75,000	50.0	delayed
Procter & Gamble	HBKP pulp	1992 ?	275,000	ADMT	0	315.0	new pulp mill in Grande Prairie, delayed
Sunpine Forest Products	Lumber	Mid 1992	80,000	Mfbm	32,000	10.0	
	Fibreboard & sawmill	Mid 1992	100,000	sq.ft. 1/8"	0	33.0	proposed
ALPAC	SBKP (20%) and HBKP (80%)	1993	493,000	ADMT	0	1300.0	
	Fine Paper	1998	300,000	tonnes	0	300.0	new fine paper mill
Procter & Gamble	HBKP pulp	1995	50,000	ADMT	0	85.0	second pulp mill expanded.
AEC	CTMP pulp	1996	110,000	ADMT	0	150.0	double capacity of Slave Lake CTMP mill
ANC	newsprint	1997	220,000	tonnes	0	350.0	double capacity of first mill
Daishowa	CTMP mill or				0		
	Paper mill	1998	150,000	ADMT	0	200.0	additional capacity added to existing mill.
YFY or	CTMP pulp	p	240,000	ADMT	0	600.0	Two proposed options for High Prairie TDA
	plus fine paper mill		120,000	tonnes	0		currently being considered by the government.
Polyboard	or OSB mill	p	620,000	sq.ft. 3/8"	0	119.0	

Various sources: Environmental Council of Alberta; Industry Development Division, Alberta Forestry, Lands and Wildlife; Pulp and Paper Week

Notes: n/a – not available; ? – denotes delayed status; p – denotes pending decision/approval; Pelican Spruce Mills now owned by Weyerhaeuser.